AERONAUTICAL ENGINEERING REVIEW

INSTITUTE OF THE AERONAUTICAL SCIENCES

SEPTEMBER 1947

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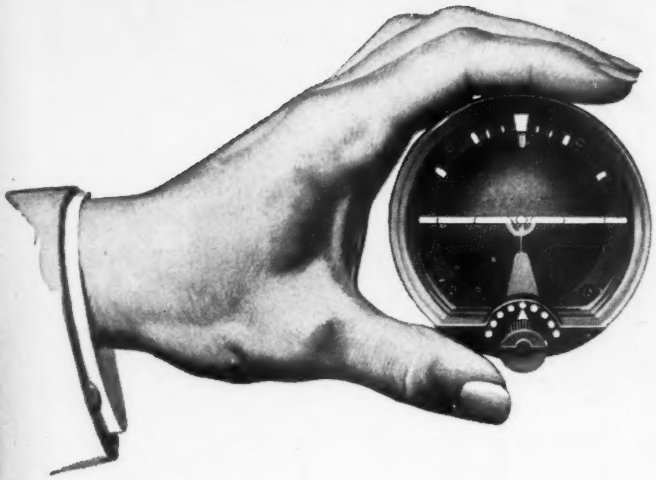

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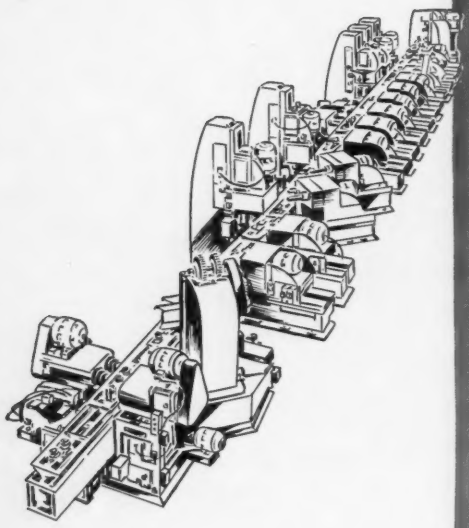

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3241

ENGINEERS AND BUILDERS OF OIL HYDRAULIC EQUIPMENT SINCE 1921

Official U.S. Navy Photograph

Cover—Curtiss SC-2 "Seahawk" as it undergoes successful rough-water landing tests at the Naval Air Test Center, Pawtuxent, Md.

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Contents

I.A.S. News 5
Editorial 17

Articles

Annual Summer Meeting and Fifteenth Anniversary Dinner 18
I.A.S. Briefs 28

Reviews

Aeronautical Reviews 33
Books 69

Sherman M. Fairchild Publication Fund Papers 27
Personnel Opportunities 79
Appreciation to Corporate Members 84
Index to Advertisers 87

Published Monthly by the Institute of the Aeronautical Sciences, Inc.

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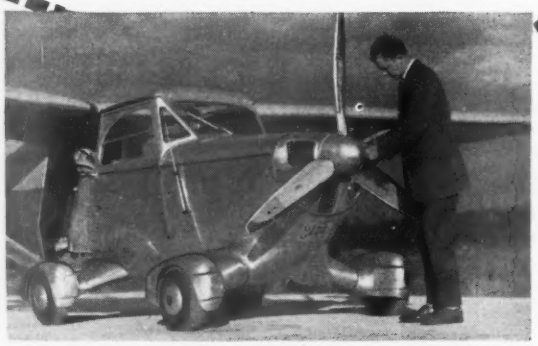

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I.A.S. News

A Record of People and Events of Interest to Institute Members

First I.A.S.-R.A.S. Conference Held in London, Sept. 2-6

Meeting Marks New Era in Interchange of Technical Information; Invitation Extended to Institute Members by Sir Frederick H. Page, Royal Aeronautical Society President

The first joint meeting of the Institute of the Aeronautical Sciences and its 81-year-old British counterpart, the Royal Aeronautical Society, was held in London, September 2 through September 6.

Marking a new era in the interchange of scientific information, the meeting was attended by more than 40 aeronautical scientists, engineers, and experts in the industry from the United States, in addition to leading British aviation authorities.

▸ **Invited by Sir F. H. Page**—Invitation to members of I.A.S. to attend the conference was extended on behalf of the Royal Aeronautical Society by Sir Frederick Handley Page, President, noted British aeronautical authority, during a visit to New York. Succeeding meetings are planned to be held alternately in the two countries in the future.

Because of housing conditions and food rationing in Great Britain, only a limited number of delegates from the United States could be selected. Two parties of I.A.S. members, totaling 22, flew to London via Pan American World Airways and American Overseas Airlines, the rest of the delegates arranging their own transportation.

▸ **Technical Sessions**—In the technical sessions, 21 papers, covering Aerodynamics, Structures, Power Plants, Stability and Control, Airworthiness and Safety, High-Speed Flight, Telemetering Helicopters, and Personal Aircraft, were read by leading American and British aviation authorities.

Final day of the conference featured a summary on the subjects of "Long-Range and Upper-Atmosphere Aircraft," "Light Aircraft," "Short-Haul and Medium-Range Aircraft," and a final summing up by Sir Frederick Handley Page.

Two sessions were held concurrently, with two papers being read at the same time in different halls.

Prior to the technical meetings, American delegates met the R.A.S. President and Council and their British opposites at a reception held at the Society's headquarters at 4 Hamilton Place, W.1.

On Friday, September 5, all delegates were invited to a reception at Lancaster House given by the British Government.

▸ **Dinner at Guildhall**—A special dinner, Tuesday, September 9, at Guildhall, one of the most famous and historic buildings in London, at which the Lord Mayor of London, the Sheriffs, and many members of the government and aircraft industry were present, was a highlight of the occasion.

Final social event was the Society's Annual Garden Party at Radlett, September 14.

Tour Factories, Air Shows—Highly interesting visits were arranged to the Miles Aircraft works and the Bristol Aeroplane Company's aircraft and engine works, where delegates saw the 125-ton Bristol Brabazon I, jet engines, helicopters, and installations.

On another occasion, American delegates were the guests of the Society of British Aircraft Constructors, visiting the Flying Display and Show at Radlett Airdrome.

J. Laurence Pritchard, Secretary, R.A.S.

In addition, the Royal Aircraft Establishment at Farnborough—similar in function to Air Matériel Command at Wright Field—was visited. The establishment covers all aspects of aeronautics except gas turbines. Members next went to the flying boat works of Saunders-Roe at Cowes, Isle of Wight. The mock-up and pressure test section of the SR/45, six-engined boat of 120 tons powered by prop-jets of 5,000 hp. each, was seen.

A demonstration of the SR/A1 single-seater, twin-engined jet flying boat was also given.

The tour ended on September 12 with a visit to the Government National Gas Turbine Establishment at Whetstone.

I.A.S. Calendar

December 17, 1947	Wright Brothers Lecture, Washington, D.C.
January 27-29, 1948	Sixteenth Annual Meeting, New York

For details see page 25

Muroc Air Base Visited by I.A.S. Members

Major Gen. Chidlaw, Colonel Gilkey Greet Institute Party of 200 August 6; Flight Demonstration of XS-1, New Jet Equipment Staged.

MORE THAN 200 I.A.S. MEMBERS, in Los Angeles for the Institute's Annual Summer Meeting, accepted an opportunity to visit the U.S. Air Forces' Muroc Air Base, arranged through courtesy of Major Gen. L. C. Craigie, then Chief of Engineering, Air Matériel Command, Wright Field, and Col. S. A. Gilkey, Commanding Officer of the base and veteran flight-test engineer-pilot.

Traveling in seven air-conditioned buses chartered by the Institute (some members proceeded by private car and plane), the party of more than 200 left the Hotel Ambassador at 7 a.m., arriving at Muroc about 9:30. An escort of three motorcycle policemen was secured from the California State Highway Patrol in order to enable the party to meet a tight schedule, dictated by flying conditions at the field, and for reasons of safety. So well organized was the trip, assisted by the police escort, that at no time was the party more than 5 min. off schedule.

▶**Review Planes and Engines**—Greeted by Colonel Gilkey and Major General Chidlaw, Deputy Chief of Engineering, Air Matériel Command, who flew in from Wright Field, Institute members were stationed in a reviewing stand erected in a hangar, out of the sun, before which airplanes and equipment were passed.

As each plane or piece of equipment rolled past, an Air Force specialist described it on the public address system. Among the jet planes shown were the North American XP-86 swept-wing version of Navy's XFJ-1, also exhibited; the Republic P-84; Lockheed P-80; the D-558 built by Douglas for Navy; the North American P-82 Twin Mustang, the Bell XS-1, and Chance Vought XF6U-1 Pirate, which features new Metalite construction of balsa wood sandwiched between sheets of aluminum alloy.

In addition to the fighters and experimental jet and rocket-powered types, there were exhibited the Douglas Mixmaster XB-42A, powered by two Westinghouse 19-XB gas turbines, augmenting the two Allisons driving the contrarotating tail prop; the Douglas XB-43, all-jet version of the XB-42A; North American XB-45, powered by four G-E J-35 units; and Convair XB-46, its J-35 units installed in nacelles tilted so the exhaust clears the tail assembly.

The 172-ft. XB-35 Northrop Flying Wing attracted considerable attention.

Among the power plants exhibited were Westinghouse and General Electric gas turbines and the Reaction Motors rocket engine, similar to the installation in the Bell XS-1.

▶**D-558 Flight**—Following the review, most of the planes shown were flown past the stand, some having begun to buzz the field before the review had ended. One of the most spectacular flights in point of speed was that of the D-558, which made several passes, one of which was rumored to have unofficially exceeded the world's speed record recently set by a P-80R. (The D-558 subsequently made an official record of 650.6 m.p.h.)

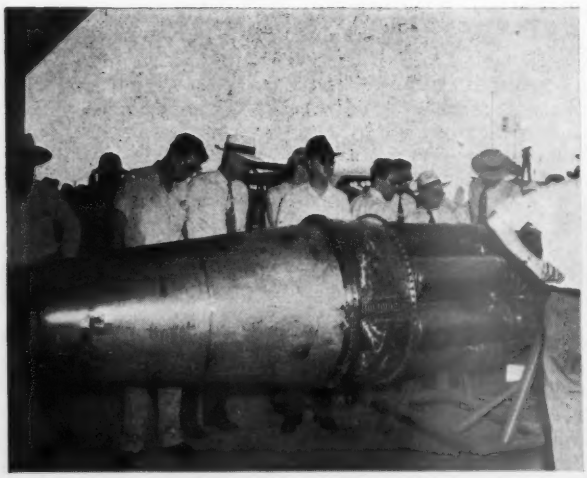
Meanwhile, a B-29, carrying the XS-1, had gone aloft, climbing to 20,000 ft. before releasing the rocket-powered test plane, which made a glide descent with Capt. Charles Yaeger, U.S. Air Force, at the controls for his first flight. Because of the great height at which the XS-1 was released, however, little was seen from the ground.

A ground demonstration of radio-controlled aircraft was given. Both mother ship and control truck demonstrated in actuating a radio-controlled P-80's flaps, ailerons, rudder, and diving brakes before the reviewing stand.

Next, P-80 Shooting Stars performed aerobatics together with the North American and Vought jets.

▶**Flying Wing Demonstration**—Flight of the Northrop XB-35 Flying Wing in formation with the tiny Northrop N9M experimental model wing made a great impression. The XB-35 made steep banking turns and climbs, demonstrating its flight capabilities.

A further spectacular demonstration was provided by a P-82 Twin Mustang with a cockpit-seat ejector. Using a dummy with parachute, the seat was discharged at 10,000 ft.



Members inspect jet unit *(left)*; watch jet fighter demonstration *(right)* at Muroc Air Base. Northrop XB-45 Flying Wing in background

shooting the dummy clear of the plane, the seat dropping away almost immediately.

In the meantime, a feature of Air Force thoughtfulness was the truck of ice-cold Coca Cola which followed members about the base, supplying much-needed refreshment with the compliments of the officers of the base.

Following a lunch in the cafeteria, the party boarded the buses for a trip to the bomber base to visit the hangars used by Consolidated Vultee, Douglas, and North American, where the planes were inspected at close range. Included among the exhibits were the speedy D-558 and the sleek, pencil-shaped XB-46 and XB-45 jet bombers.

The party, again boarding the buses, crossed the Dry Lake, stopping to examine the bottom, which has been tested and found capable of bearing concentrated loads of 150,000 lbs. per wheel. This is sufficient for the heaviest aircraft so far designed and in production.

Returning to the main base, the entire party was gathered together for the return trip to Los Angeles, arriving at approximately 6:30 p.m.

I.A.S. Newslines

▸**Charles H. Colvin,** a Past-President and Fellow of I.A.S., was appointed to President Truman's Air Policy Commission as a full-time specialist on industry relations.

▸**James H. Doolittle,** President, Air Force Association, has announced establishment within the Association of a publishing organization for *Air Force* magazine, official organ of A.F.A. A Past-President of the Institute (1940), Doolittle is a Fellow of I.A.S.

▸**Dr. Nicholas J. Hoff,** Associate Fellow of I.A.S. and Professor of Aeronautical Engineering at Polytechnic Institute of Brooklyn, has been appointed to the Scientific Advisory Board of the U.S. Air Force.

▸**Gordon H. Strom,** an Associate Fellow of I.A.S., was made Associate Professor of Aeronautical Engineering in New York University's College of Engineering.

▸**T. P. Wright,** C.A.A. Administrator and I.A.S. Past-President (1938) and Honorary Fellow, signed the revised Federal-Aid Airport Program for construction or improvement of 908 airports.

▸**Col. Hollingsworth F. Gregory** was appointed Chief, Reconnaissance and Photography Branch, Requirements Division, Hq., U.S. Air Force. Colonel Gregory is an Associate Fellow of the Institute.

Receives Bane Award: Adolph L. Berger, Mechanical Engineer of Air Matériel Command, Wright Field, receives The Thurman H. Bane Award from I.A.S. President P. R. Bassett at Los Angeles Summer Meeting.

Bane Award Presented to Military Technician

Adolph L. Berger, Mechanical Engineer, Power Plant Laboratory, Engineering Division, Air Matériel Command, Wright Field, received The Thurman H. Bane Award for 1947. The award, given annually by the Institute of the Aeronautical Sciences to an officer or civilian in Matériel Command for an outstanding achievement in aeronautical development during the year, was presented on the occasion of I.A.S.'s Annual Summer Meeting in Los Angeles on August 6.

Established by Major R. H. Fleet, the Award is in memory of Col. Thurman H. Bane, one of the most prominent technical officers of the U.S. Army Air Corps, who died in 1932.

Committee of Award, consisting of W. Stuart Symington, Assistant Secretary of War for Air; General Carl Spaatz, Commanding General, U.S. Air Force; Dr. E. U. Condon, Director, National Bureau of Standards, and Preston R. Bassett, President of I.A.S., selected Berger for his "Development Applications of High Temperature Ceramic Materials to Military Aircraft."

In order to withstand the high temperatures in the new types of military aircraft engines—turbojet, turboprop, ram-jet and rocket engines—Air Matériel Command found it necessary to use large quantities of scarce alloying materials such as nickel, cobalt, tungsten and columbium. This was the factual situation presented to Berger who, as a result of approximately 30 years of experience in dealing with high temperatures in the form of engine exhaust gas for driving superchargers, foresaw the possibility of using less critical materials, such as low-carbon steel, for high-temperature locations when coated with ceramic materials.

Mr. Berger proceeded to develop new types of high temperature ceramic materials for coating low-alloy metals and developed background data for subsequent investigations and applications to many new aircraft engine types.

Standard Aeronautical Index Completes Organization

The Standard Aeronautical Index project, set up by Army-Navy contract with the Institute, has completed main organization details, including a full-time representative on the West Coast and another at Dayton, in addition to the main office in New York.

Headed by Leslie E. Neville, Director, S.A.I.'s staff now totals ten, including clerical assistants. In addition to selecting personnel, S.A.I. has arranged contacts with Government agencies and members of the aviation industry in order to enlist their cooperation in preparation of the Index; selected Advisory Committees composed of experts in particular fields to assist the Index staff; and assembled and studied existing classification lists and subject headings in the aeronautical field as a part of a reference file.

▸ **Standardization Needed**—Need for standardization of subject breakdowns has been apparent for some time. The new program of Materiel Command's Air Document Division for accelerated dissemination of technical information under the Air Tech-

College of Aeronautics Receives Klystron: Robert B. Lea *(left)*, Vice-President of Sperry Gyroscope Company, Inc., presents famous flying laboratory, "Klystron," to Capt. Allan Hancock, Director of University of Southern California College of Aeronautics, in ceremony at Hancock Field, Santa Maria. Plane has been loaned to the school for aeronautical engineering research.

nical Index greatly emphasized this need.

In the development of the Air Technical Index it was recognized that previous indexing systems did not allow the individual researcher or engineer to get up-to-date information in small groups pertinent to his particular field.

▶ **S.A.I. to be Functional**—Since the Standard Aeronautical Index is to be functional, first breakdown of aeronautical and allied sciences is dictated by the division of the field into specialized organizations or groups as the science is practiced, developed, or taught. These groups, defined in S.A.I. as Divisions, include Aerodynamics, Structures, Power Plants, Mathematics, etc. As the more obscure phases are examined, however, it becomes evident that considerable research and coordination must be carried out in development of the proper definition for these Divisions.

Initiation of the Air Technical Index, the A.T.I. Technical Data Digest, and similar intelligence services furnished by the Government to its contractors has made it imperative to expedite this undertaking. The Standard Aeronautical Index will make it possible for the recipient of these services to keep up-to-date with the rapidly increasing documentation in his area of interest without wading through data not pertinent to his particular work.

Sperry's Flying Lab Loaned to University of Southern California

The famous Lockheed Hudson flying laboratory, "Klystron," long used in experiments both before and during the war, has been loaned by Sperry Gyroscope Company, Inc., to University of Southern California College of Aeronautics for research work.

Flown from the Sperry flight research center at Great Neck, L.I., N.Y., to the West Coast, the flying lab was presented to Capt. Allan Hancock, President of the U.S.C. Board of Trustees and Director of the College of Aeronautics, by Robert B. Lea, Vice-President of Sperry.

In accepting Klystron at Hancock Field, Santa Maria, Captain Hancock said: "This ship has contributed much to the advancement of aeronautical science. . . . . We will do our best to help the Klystron maintain her enviable reputation."

▶ **Known the World Over**—Known to leaders in aviation research throughout the world, the Lockheed Hudson during the War figured in experiments and tests of gyropilots, radar detection units, flight instruments of all kinds, landing instrument systems, homing devices, bomb sights, and other advanced aeronautical gadgets, some still on the secret list.

As the first aircraft built specifically for flight research, Klystron eventually will be given to the National Aeronautical Museum, recently provided for by Congress.

S.E.S.A. Meeting in December

The Society for Experimental Stress Analysis has announced its annual meeting will be held at the Hotel Pennsylvania in New York on December 4–6, 1947.

Inquiries should be addressed to the Society for Experimental Stress Analysis, Box 168, Cambridge 39, Mass.

Northrop Gets A.S.M.E. Honor for Flying Wing

The Spirit of St. Louis Medal, highest aviation honor of the American Society of Mechanical Engineers, was awarded to John K. Northrop, President of Northrop Aircraft, Inc., September 3, for his development of the "Flying Wing" and other aeronautical scientific contributions.

▶ **"Originality and Vision"**—The medal, conferred at A.S.M.E.'s annual Fall Meeting banquet in Salt Lake City, read:

"To John Knudsen Northrop: For his originality and vision in the engineering of military and commercial airplanes, and particularly for his development of a successful flying wing."

A.S.M.E.'s medal commemorates the lone transatlantic flight of Charles A. Lindbergh in 1927 and is awarded every third year "for meritorious service in the advancement of aeronautics."

Northrop, whose contributions to the science of aeronautics are many, is a Fellow of I.A.S.

Receives Top A.S.M.E. Honor: John K. Northrop, President of Northrop Aircraft, Inc., was awarded the Spirit of St. Louis Medal, highest aviation honor of American Society of Mechanical Engineers at annual Fall Meeting in Salt Lake City

Gifts to the Institute Collections

Capt. John Jay Ide presented volumes of technical papers and booklets relating to demonstrations of radio aids to navigation held in England in September, 1946, for members of the Provisional International Civil Aviation Organization. Dr. Alexander Klemin added 87 books to his previous generous gifts. French books and periodicals were received through the courtesy of the Air Attaché to the Ambassador of France. Lt. Col. Nathaniel F. Silsbee gave volumes of the *S.A.E. Transactions* for 1943, 1944, and 1945. Col. Charles C. Grote gave a copy of *Deutsche Flugzeugbau; Handbuch der Luftfahrttechnik*, Berlin, 1942.

The Aviation Education Division of the U.S. Civil Aeronautics Administration presented bibliographies and other publications relating to aviation education.

The U.S. Weather Bureau gave 17 of its *Research Papers*. The British Supply Office in Washington continued its previous generous gifts with *R.T.P. Translations* and indexes to them, and *R.T.P. Bibliographies*. The Aero Medical Laboratory of the Engineering Division, Air Matériel Command, sent 19 aeromedical reports through the courtesy of Col. Edward J. Kendricks. Reports of the Landing Aids Experiment Station at Arcata, Calif., were received from the Air Matériel Command through the courtesy of Col. Fred R. Dent. Two translations were added to its previous generous gifts by the David Taylor Model Basin. The Bureau of Aeronautics of the Navy Department added twelve *CGD* series reports to its previous generous gifts.

Air labels and time tables were sent by Leroy V. Coburn and Mrs. Edna Welker, adding to their previous gifts. A sample of paper made by Montgolfier et Cie, bearing their balloon watermark, was presented by James Fitzpatrick. Arthur Halstead presented a copy of his solution of airplane turn stalls. An outline of his Classification of Aeronautical Subjects was presented by Francis B. Alexander. Operation manuals and reports dealing with the DC-3, DC-4, and DC-6 airplanes and a drafting manual were received from the Douglas Aircraft Company, Inc.

Additional gifts were received from the Aero-Club de France; Air Transport Board of Canada, courtesy of J. J. Green; Aircraft Industries Association; *Chicago Tribune*, courtesy of J. Loy Maloney; Dow Corning Corporation; Polytechnic Institute of Brooklyn; Special Libraries Association, and the U.S. Air Matériel Command; Census Bureau; Civil Aeronautics Administration; Bureau of Aeronautics of the Navy Department; Library of Congress; Congressional Committees on appropriations and interstate and foreign commerce; and the House and Senate Document Rooms.

Corporate Member News

● **Aeronca Aircraft Corporation** was granted an import license by Australia, Australian civil aviation authorities revealed.

● **Aeroquip Corporation** has announced "cost-of-living" allowances for employees earning less than $300 per month who have been employed continuously for 6 months. Allowances are: $10 per month for wife or fully dependent husband; $5 per month for each dependent child under 18 years of age; maximum of $25 per month.

● **American Airlines System** is to retire all its DC-3's by next April in favor of Convair Liner (the 240) and DC-6.

● **American Overseas Airlines, Inc.,** has converted its Constellations from 39-passenger to 43-passenger capacity. Gross weight limitations of the "Connies" will not be affected, since the four extra seats will take up weight formerly used for cargo, which was shifted to all-cargo planes.

● **Bell Aircraft Corporation** is expanding its helicopter mechanics training course from 2 to 5 weeks, will admit qualified general students. Admission previously was confined to company and customer personnel. . . . . British Isles helicopter sales agency of company has been assigned to Irvin-Bell Helicopter Sales Ltd., Letchworth, Herts., with headquarters at Scottish Aviation Ltd., Prestwick Airport, Scotland.

● **Boeing Aircraft Company's** facilities and operating equipment for the GAPA guided missile project have been transferred from Wendover, Utah, to Alamagordo, N.M. Move was made, Air Force said, to consolidate all missile and rocket experiments in proving ground area. . . . . Company sponsored 3-day symposium on high-altitude flight in Seattle, August 25–27.

● **Curtiss-Wright Corporation's** Columbus Division has begun plant reconditioning and overhaul program costing more than $58,000 for materials alone.

● **Eastern Air Lines, Inc.,** has adopted an employees' pension plan based on current values and today's business conditions, effective October 1. . . . . E.A.L.'s new maintenance building planned at Miami is to cost more than $1,000,000 fully equipped. Building of structural steel construction will be 570 ft. long, three stories high, and have 180,600 sq.ft. floor space. Addition will increase company's total area to 465,000 sq.ft., will accommodate eight planes simultaneously.

● **Pan American World Airways System's** Employee Suggestion Committee awarded Munford E. Topping, schedule coordinator and liaison man between P.A.A.'s traffic and operations departments in Miami, $500 for idea valued by company at $20,000 a month. Topping received award for his plan to standardize seating arrangements of four-engined Clippers at 52 seats each.

● **Republic Aviation Corporation** closed from August 1 to August 11 in line with company's policy of closing all manufacturing operations for one week to afford employees simultaneous plant-wide vacation.

● **Trans World Airline** showed a profit of about $300,000 for May and June, it was announced by LaMotte T. Cohu, President.

● **United Air Lines, Inc.,** has moved its engineering department and maintenance division from Chicago to San Francisco.

● **Western Air Lines, Inc.,** has adopted new ticketing procedure to facilitate transfer of eastbound passengers to United Air Lines planes at Denver. . . . . Company also operates cooperatively in ticket and airport service operations with American in San Francisco.

Sections and Branches

Dayton Section

E. W. Robischon, *Secretary*

A "Ladies Night" meeting was held July 24 at the Miami Valley Golf Club in lieu of a technical session. Films of many interesting aspects, features, and oddities of aviation were shown.

Washington Section

Milton B. Ames, Jr., *Secretary-Treasurer*

Newly elected officers of the Section were announced as follows: Ivan H. Driggs, Chairman; E. J. Foley, Vice-Chairman; and Milton B. Ames, Jr., Secretary-Treasurer.

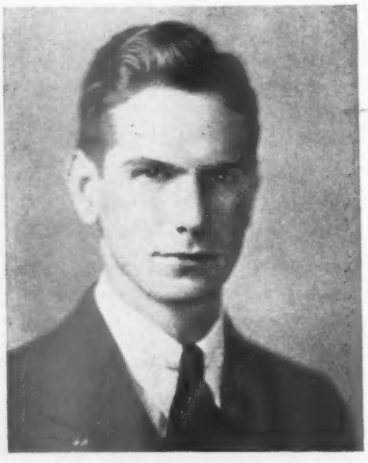
A Fellow of the Institute, Mr. Driggs is Director of the Design Research Division, Bureau of Aeronautics, Navy Department.

Foley presently is Assistant to the Vice-President, American Airlines System and American Overseas Airlines, Inc., Washington office.

Ames is head of the Aerodynamics Research Branch at N.A.C.A. Washington headquarters.

Ivan H. Driggs.

E. J. Foley.



Milton B. Ames.

Academy of Aeronautics

Nominations for Branch officers for the term September, 1947, to March, 1948, made at a special meeting, June 17, were voted upon at the July 1 meeting with the following results: Chairman, Marvin Glenn; Vice-Chairman, John Korbuszewski; Treasurer, Russell Lee; Secretary, Arthur Kneuer; and Sergeant-at-Arms, George Lord.

Aeronautical University

The July 16 meeting of the Branch, held in the Central YMCA in the "Loop" district of Chicago, featured two films: *Mass Production at River Rouge*, and *The Phantom*. The former showed production methods in the manufacture of the Ford car from steel mill to the finished product. The second film showed the testing of the McDonnell Phantom on its carrier qualification flights and pointed up the difference in current carrier planes and the jet type.

Presiding officer was William Stakee, Chairman.

Alabama Polytechnic Institute

Two meetings were held in July under chairmanship of Lionel Levy, Jr. At the July 8 meeting, the Branch voted to financially back publication of *The Auburn Engineer*. Advance announcement of the election of some graduation officers was also made. A film, *The Phantom*, was shown.

At the July 22 meeting, John D. Roddom was elected treasurer and Owen B. Munro and James L. Sanders were elected as alternate representatives to the local Engineers Council. Four new members were recruited.

University of Alabama

Third and last meeting of the spring quarter was opened May 27 by Chairman Ross B. Robinson.

Two films, *Construction of a Light Airplane*, and *Building a Bomber*, were shown. Production methods in building the Piper Cub, illustrated in the first, and of a heavy bomber, shown in the second, offered an opportunity to compare production methods of heavy and light planes.

Officers elected for the 1947–1948 term were as follows: Joseph E. Fikes, Chairman; John C. McFall, Vice-Chairman; and Robert M. Hunt, Secretary-Treasurer.

University of Illinois

First meeting of the summer semester, July 2, was given over to a ball game between instructors and members of the Branch—score: instructors 14, Branch Members 26. A short business session was held immediately following the game. New members for the summer: Thomas Dolan, Robert Moss, Rollin Bullinger, and James Batton. Chairman of the meeting was John McGuire.

Parks College of Aeronautical Technology

Branch members at the July 17 meeting heard Edward H. Barker, Head of the Aeronautical Engineering Department, Parks College, on subject of "The Engineer's Place in the Industry." The lecture pointed out what the young graduating engineer should expect when entering the industry. Barker also mentioned the changing needs of the aviation industry for specialized men and the opportunities available.

A film, *The Magic Carpet*, was also shown. Made by Bell Aircraft Corporation, it presented the practicability of the helicopter and the services obtained from rotor-type aircraft.

Charles F. Jahn, Chairman, announced that the I.A.S. will sponsor the Aeronautical Engineer banquet to be held on September 9.

Spartan College

Meeting of July 7 was called to order by Charles Gruenberg, Acting Chair

man since graduation of Chairman Sherrill.

Main purpose of meeting was to elect a new Chairman, Secretary, and Treasurer. Newly elected officers are: Charles Clift, Chairman; Max Peterson, Secretary; and Nicholas Williams, Treasurer.

Stewart Technical

Two meetings were held in July, on the 1st and 18th, chairmanned by Robert W. Wagner. A film was shown at each meeting: *Tornado in a Box* on July 1 and *Report on Jet Propulsion* on July 18.

News of Members

Edward J. N. Archbold is now Aerodynamicist with Bristol Aeroplane Company (Aircraft Division).

Gerald H. Backer, formerly Associate Professor of Aeronautical Engineering, Alabama Polytechnic Institute, is Head Aerodynamicist (Consulting Engineers), Sverdrup & Parcel.

Joel Robert Baker, Jr., was named Engineer Test Pilot, Chance Vought Aircraft Division, United Aircraft Corporation.

Hans Gunter Belitz, is with Commonwealth Engineering Company of Ohio as Design Engineer.

Ward A. Beman, Chief Aeronautical Research Engineer, Lockheed Aircraft Corporation, is resigning. Beman intends to launch new firm, Telecomputing Engineering Company.

Walter Wallace Bird is now Head, Technical Section, Experimental Department, Cornell Aeronautical Laboratory.

Paul M. Birk is Structures Engineer, Cornell Aeronautical Laboratory.

Morgan M. Blair, formerly with Globe Aircraft Corporation, is Project Aerodynamicist, North American Aviation, Inc.

Luther J. Boyer is Flight Test Engineer, Chance Vought Aircraft Division, United Aircraft Corporation. Boyer recently received degree of M.Sc. in Aeronautical Engineering from Purdue University.

Gregory J. Brandewiede is Materials Director, American Airlines System.

Thomas L. Brewer, formerly with the Navy, is Aerodynamicist, Consolidated Vultee Aircraft Corporation. He received Master's degree in Aeronautical Engineering recently.

William W. Brinckerhoff was named President, Air Carrier Service Corporation, and President, Air Carrier Supply Corporation.

Donald F. Brodie is Liaison Engineer, Bell Aircraft Corporation; was formerly with Curtiss-Wright Corporation, Buffalo plant, as Engineer.

Ben George Bromberg is in Charge of Guidance and Control, Guided Missile Section, McDonnell Aircraft Corporation. Bomberg recently received D.Sc. degree from Massachusetts Institute of Technology.

William E. Brown, formerly with Curtiss-Wright Corporation, is Project Engineer, Bell Aircraft Corporation.

Edward E. Brush is Head, Department of Aeronautical Engineering, A & M College of Texas.

Oren W. Bryant has returned to active duty with Ordnance, U.S. Army, with rank of Lieutenant.

Gifford Bull is Engineer, Cornell Aeronautical Laboratory.

John E. Burgeson, formerly Structural Engineer with Ryan Aeronautical Company, is Assistant Design Engineer in Structures Department, McDonnell Aircraft Corporation.

Charles H. Busey is Helicopter Engineer, Bell Aircraft Corporation.

Melvin L. Douglass, formerly with Douglas Aircraft Company, Inc., is now Wing Layout Draftsman, McDonnell Aircraft Corporation.

James B. Duke is Analytical Engineer, Hamilton Standard Propellers Division, United Aircraft Corporation.

Eugene C. Eakin, formerly Stress Analyst with Douglas Aircraft Company, Inc., now is Project Weight Engineer, McDonnell Aircraft Corporation.

William H. Eisele is Development Engineer with Thompson Products, Inc.

Ahmed C. Eringen, formerly Structural Design Engineer with Etimesgut Aircraft Factory, Turkey, is Senior Research Fellow, Polytechnic Institute of Brooklyn.

Calendar

I.A.S. Section Meetings

NIAGARA FRONTIER—OCT. 23
Hotel Statler, Buffalo, N.Y.
Speaker: A. Flax
"Helicopter Loads and Load Factors"

PHILADELPHIA—SEPT. 30
Engineer's Club of Philadelphia
Speaker: Captain Poppin
"The Flight Surgeon Looks at Current Aeronautical Problems"

SAN DIEGO—OCT. 3
Gold Room, U.S. Grant Hotel
Speaker: R. S. Shevell
"Operational Aerodynamics of High-Speed Transport Aircraft"

TORONTO—OCT. 15
Harthouse, University of Toronto
Speaker: H. S. Rees
"Airworthiness Requirements, Past, Present, and Future"

Glenn E. Graham resigned from Boeing Airplane Company to take position as Executive Engineer, Jeppesen & Company.

James F. Green, formerly with Curtiss-Wright Corporation, is now a licensed pilot-instructor in Aeronautical Engineering Department, Clearfield Aviation Institute.

Vernon R. Grom is Plants Quality Coordinator, Division Parts, Sylvania Electric Products.

Karl Hans Guttmann was appointed Aerodynamicist-Thermodynamicist, Bureau of Aeronautics, Navy Department (Washington, D.C.).

Bruce R. Haight is Pump Designer, Curtiss-Wright Corporation.

Sam D. Heron, formerly Research Engineer with Ethyl Gasoline Corporation, is now a Consulting Engineer.

Dr. Gabriel Horvay is with General Electric Company as Physicist—Consulting Department, Engineering General Division.

Richard S. Huntzinger is Senior Stress Analyst, The Glenn L. Martin Company.

Ely H. Ice, formerly with Curtiss-Wright Corporation, was named Vice-President and General Manager, Indiana Plymould Corporation.

Edward J. Ill, II, was named President of Lansaire Corporation. He formerly was Assistant to Vice-President in Charge of Design, Bendix Helicopter, Inc.

Clyde B. Johnson, Jr., is Assistant Aerodynamic Design Engineer, McDonnell Aircraft Corporation.

Robert W. Johnson resigned as Instructor, Iowa State College, to become Junior Engineer, Shell Oil Company.

Felix Kallis is Power Plant Test Engineer, Ryan Aeronautical Company.

Dr. Ernest G. Keller resigned as Chief Research Engineer with Curtiss-Wright Corporation to rejoin General Electric Company in Schenectady, N.Y.

Joseph M. Kleinman is Technical Writer with Sperry Gyroscope Company, Inc.

Richard K. Koegler resigned from Curtiss-Wright Corporation to become Project Engineer—Helicopter, Bell Aircraft Corporation.

Alexander Krivetsky is Project Stress Engineer with Bell Aircraft Corporation.

Edward Kurzawa, formerly with Weatherly Campbell Aircraft as Chief Engineer, now is Product Engineer and Sales Engineering, Airport Construction Company.

George Kroening, Jr., is Engineer, American District Steam Company.

Anthony J. Larrecq is President of Power Generators Ltd.

Bernard M. Leadon, formerly with Curtiss-Wright Corporation, is Lecturer in Aeronautical Engineering, University of Minnesota.

Bernard B. Levitt is with Northrop Aircraft, Inc., as Aerodynamicist.

Tung Hua Lin, a Lieutenant Colonel in the Chinese Air Force, is on the Commission on Aeronautic Affairs of the Republic of China, London, England.

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Arthur L. Lowell is in Charge of Aerodynamics and Propulsion, Pilotless Aircraft Department, McDonnell Aircraft Corporation.

Johann F. Ludloff was promoted to Associate Professor of Aeronautical Engineering in New York University's College of Engineering.

Stanley Lynn is owner of Lynn Engineering & Supply Company.

Dale W. McKee is Design Engineer with Bell Aircraft Corporation.

F. Bruce Mercer, formerly an engineer with Boeing Aircraft Company, is a partner in the firm of Mercer-Ashenfelter (Automobile Dealers).

John R. Meyer is with United Aircraft Corporation as Research Engineer, Research Laboratory.

Arthur W. Miller resigned from American Airlines System to join Teleflex, Inc., as Sales Engineer.

Hans S. Mueller is with Northwest Airlines, Inc., as Flight Control.

Dr. Felix Nagel, formerly with Engineering & Research Corporation, is Aircraft Designer, Aircraft Development Division, General Electric Company.

John A. Nicas resigned from Boeing Aircraft Company to become Group Leader, Technical Publications, Trans-Canada Air Lines (Canada).

William M. Ostapenko has been appointed Lieutenant Commander, in charge of all Officer and Enlisted Personnel in aviation ground training at the U.S. Naval Air Station, Olathe, Kan.

Albert M. Patterson is President and Chief Engineer, Aeronautical Manufacturing Corporation.

Charles W. Penry, former Air Forces Captain, is Superintendent of Maintenance, Memphis Flying Service, Inc.

William H. Peters is Research Engineer, Cornell Aeronautical Laboratory.

James R. Petters, former Ensign U.S.N.R., now is Junior Engineer, Linde Air Reduction Company.

Roland W. Puder is Research Engineer, The Texas Company.

John H. Quinn, Jr., is Aerodynamics Engineer, Chance Vought Aircraft Division, United Aircraft Corporation.

Lamar A. Ramos, Jr., was appointed Assistant Aerodynamicist, McDonnell Aircraft Corporation.

Charles W. Ranson, formerly with United Aircraft, is Engineer (Aeronautical), Piasecki Helicopter Corporation.

Edgar Peter Rhodes resigned from Ryan Aeronautical Company to become Designer, Consolidated Vultee Aircraft Corporation.

William E. Roberts, Jr., is Assistant Design Engineer with McDonnell Aircraft Corporation.

Tracy M. Rozelle, Jr., resigned from Curtiss-Wright Corporation to become Designer, Bell Aircraft Corporation.

Elbert R. Sargent is Research Engineer, Helicopter Department, McDonnell Aircraft Corporation.

Hermann Schoenen is Research Laboratory Analyst, Class A, Boeing Aircraft Company.

Leon Z. Seltzer was named Plant Manager and Engineer, Fred Seltzer Company.

James F. Simpson is Designer, Scintilla Magneto Division, Bendix Aviation Corporation.

Emil L. Sorenson, former Major, U.S. Army Air Forces, is Aerodynamics Engineer, Douglas Aircraft Company, Inc.

Emerson W. Stevens is Assistant Project Engineer, Bell Aircraft Corporation.

Walton E. Tinsley, formerly Engineer, Servo Corporation of America, now is with Pilotless Plane Division, Fairchild Engine & Airplane Corporation, as Electronics Engineer.

William R. Walley, former Ensign, U.S.N.R., is Aerodynamicist, Douglas Aircraft Company, Inc.

George W. Westphal is Structures Engineer with Aeronca Aircraft Corporation.

John G. Wilder, Jr., resigned from Curtiss-Wright Corporation to become Section Head of Experimental Section, Propulsion Branch of Aeronautics Department, Cornell Aeronautical Laboratory.

Walter C. Yager is Chief Engineer, McGregor's, Inc.

John W. Young was appointed Captain, Pan American Airways, Inc.

Dr. John E. Younger is Professor of Structures, A.I.T., C.O.C.T.A. (Brazil).

Samuel Yudewitz is Research Associate, Research Division, New York University.

Rahland C. Zinn has been named Industrial Relations Manager of Pan American World Airways, Latin American Division.

Members Elected

The following applicants for membership or applicants for change of previous grade have been admitted since the publication of the list in the last issue of the REVIEW.

Elected to Associate Fellow Grade

Clark, John Russell, B.S. in Ae.E.; Project Engineer, Chance Vought Aircraft Div., United Aircraft Corp.

Transferred to Associate Fellow Grade

Burroughs, Kenneth Leland, B.S.; Vice-President, The Aeronautical University, Inc.

Churbuck, Lewis Marshall, B.S.; LL.B.; President, The Aeronautical University, Inc.

Elected to MEMBER Grade

Axell, O. Goran, Civilingenjör; Research Engineer, Projection Department, Royal Swedish Air Board.

Bates, Dana Barker, A.B. and M.E.; Walter Dorwin Teague (Consultant to Boeing Aircraft Co.).

Bussiere, René, B.Sc. (Math. and Physics); Sr. Weights Engineer, Republic Aviation Corp.

Finch, Volney Cecil, S.M. in Ae.E.; Prof. of Mech. Engineering, Stanford University.

Gerdan, Dimitrius, B.S. in M.E.; Chief Engine Engineer Allison Div., General Motors Corp.

Haglund, Gerhard Oscar, M.S. in M.E.; Head, Electro-Mechanics Dept., Fredric Flader, Inc.

Haney, William Russell, Jr., B.M.E.; Design Engineer, Power Plant Group, Goodyear Aircraft Corp.

Hess, William Harmany, B.S.; Engineering Designer, Guided Missiles Group, Douglas Aircraft Co., Inc.

Kernicky, William John, Chief Draftsman, Chase Aircraft Co.

Knoblock, Saul, B.S. in M.E. (Aero); Aero Engineer P-5, Bureau of Aeronautics Representative at Curtiss-Wright Corp., U.S. Navy.

Lee, Frederick B., A.B. (Physics); Executive Asst. to Administrator, C.A.A.

Lippert, Joseph, Jr., B.Ae.E.; Aerodynamicist, Grumman Aircraft Engineering Corp.

Mann, Kenneth, B.S. in Ae.E.; Structures Engineer, Rotor-Craft Corp., and Instructor in Aerodynamics, Cal-Aero Tech. Inst.

Miller, Rene H., B.S. (Aero. Eng.); Assoc. Prof., Rotating Wing and Airplane Design, M.I.T.

Owen, Edward Morgan, A.B.; Chief Experimental Pilot, Chance Vought Aircraft Div., United Aircraft Corp.

Rogers, William Lester, B.S. in A.E.; Sr. Design Engineer, Head of Solid Propellant Design Section, Aerojet Engineering Corp.

Schaub, Carlton Henry, B.S. in Ae.E.; Design Engineer, Kellett Aircraft Corp.

Scott, Neal Thompson, B.S.; Flight Test Engineer, North American Aviation, Inc.

Short, Joseph V., Engineer, Engineering Staff, Standard Vacuum Oil Co.

Smith, Henry Grady, Jr., B.S. (Ae.E.); Chief Stress Engineer, Hughes Aircraft Co.

Sparrow, William Thompson, Jr., B.S. in Ae.E.; Sr. Flight Test Engineer, The Glenn L. Martin Co.

Tamburello, Vito, B.S. in Physics; Aero. Engineer, Aerodynamic Investigations, David Taylor Model Basin, Navy Department.

Tatge, Robert James, B.S. in M.E.; Field Service Engineer, AGTD, Westinghouse Electric Corp.

Terradas, Esteban e Illa, D.Sc.; Prof. of Vibrations in Structures, National Institute of Aeronautics (Spain).

Venator, Tom Jess, B.S.-M.E.; Design Engineer in the Aviation Gas Turbine Div., Westinghouse Electric Corp.

West, Edward, Jr., A.B.; President, West Engineering Co.

Transferred to MEMBER Grade

Alperin, Morton, M.S.; Aerodynamicist, Jet Propulsion Lab., Calif. Inst. of Tech.

Anderson, Joseph Lorain, B.S. in Ae.E.; Aero. Engineer, Ames Aero. Lab., N.A.C.A.

Angell, Donald Willard, B.S.E.; Structures Engineer, Aeronca Aircraft Corp.

Braslow, Albert Louis, B.A.E.; Aero. Engineer P-4, Stability and Control Section, Langley Mem. Aero. Lab., N.A.C.A.

Burns, Robert Rudolph, B.Ae.E.; Lt. Col., Commanding Officer, Marine Service Squadron, U.S. Marine Corps.

Cameron, John Elza, B.S. in Ae.E., Engineering Designer "B," Boeing Aircraft Co.

Cherry, Horace Heston, B.S. in Ae.E.; Designer, Preliminary Design Section Douglas Aircraft Co., Inc.

Cornog, Robert Alden, Ph.D. (Physics).

Crotsley, Harmon Heaton, B.S.; Aerodynamicist "A," North American Aviation, Inc.

Duffendack, John Clarence, Jr., B.S. E. (Aero. and Mech.); Power Plant Lab. Manager, Lockheed Aircraft Corp.

Dunn, Orville Redmon, B.S. in Ae.E.; Stability and Control Engineer, Aerodynamics Section, Douglas Aircraft Co., Inc.

Gray, Ian Alexander, B.Ae.E.; Service Engineer, Overhaul Plant, Canadian Pacific Airlines, Ltd. (Canada).

Hage, Robert Evans, M.S. in Ae.E.; Sr. Group Engineer, Preliminary Design Section, Boeing Aircraft Co.

Hannifin, Everett A., B.S. in Ae.E.; Instructor, School of Engineering, The Aeronautical University, Inc.

Haskell, Clifton Roy, M.E.

Holmes, William Squire, B.Ae.E.; Layout and Design on Guided Missiles, McDonnell Aircraft Corp.

James, Heighton Day, B.Ae.E.; Structures Engineer, Northrop Aircraft, Inc.

Jeppeson, Norman Lutz, B.S. in C.E. (Structural Option); Staff Engineer, Goodyear Aircraft Corp.

Joanides, Jack Constantine, B.S. in Ae.E.; Stress Analyst "A," North American Aviation, Inc.

Johnson, William Arthur, Jr., B.S in M.E.; Design Engineer, McCulloch Motors Corp.

Kelley, George Mortimer, Jr., In Charge of Engineering, Loft and Template Reproduction Department, The de Havilland Aircraft of Canada, Ltd.

Lampert, Seymour, M.S. in Ae.E.

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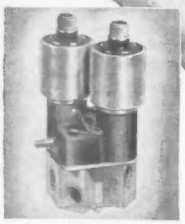
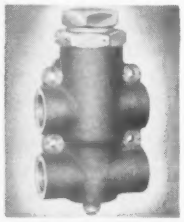


Selector Valve, No. 16475—3000 psi, Solenoid-Operated with manual over-ride.



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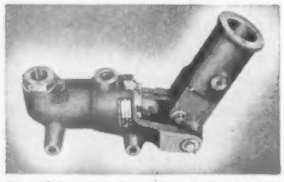

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Libby, Paul Andrews, M.S.; Instructor in Aeronautical Engineering, Polytechnic Inst. of Brooklyn.

Lindblad, Herbert Paul, B.Ae.E.; Sr. Stress Analyst, Republic Aviation Corp.

Merkin, Eugene, B.Ae.E.; Sr. Stress Analyst, Republic Aviation Corp.

Norris, Alexander Richner, M.S. in Ae.E.; Sr. Structures Engineer, Chase Aircraft Co.

Oconnicof, William Alexander, B.S. in Ae.E.; Aerodynamicist, Ryan Aeronautical Co.

Palmer, Albert Eugene, B.S. in A.E.; Asst. Project Engineer, Pilotless Aircraft Project, Consolidated Vultee Aircraft Corp.

Pearsall, David Williams, M.S. in Ae.E.; Captain, U.S.A.A.F.

Pettingall, Charles Edward, Jr., B.S. in M.E.; Aerodynamics Engineer, Development Section, Douglas Aircraft Co., Inc.

Puckett, Allen Emerson, B.S. in M.E.; Chief, Wind Tunnel Section, Jet Propulsion Lab., Calif. Inst. of Tech.

Rubin, Norman Nehemiah, B.S. in M.E.; Research Engineer, Jet Performance, Flight Data Branch, A.M.C. (Wright Field).

Scott, John Frederick, B.S. in Ae.E.; Service Engineer, Consolidated Vultee Aircraft Corp.

Sirc, Joseph Howard, B.S. in M.E.; Instructor, University of Pittsburgh.

Sloan, Lloyd Hamilton, Aerodynamicist, Piasecki Helicopter Corp.

Staros, Basil, S.B. in Ae.E.; Research Engineer, Jet Aero. Lab., Calif. Inst. of Tech.

Strible, Ferdinand Charles, Jr., B.S. in M.E.; Sr. Stress Analyst-Squad Leader, Structural Test Department, The Glenn L. Martin Co.

Stuart, Joseph, III, M.S. in A.E.; Project Engineer, United Helicopters, Inc.

Sullins, Robert Timothy, Jr., B.S. in C.E.; Stress Analyst "A," Consolidated Vultee Aircraft Corp.

Tint, Robert S., B.S. in Ae.E.; Sr. Stress Analyst, Republic Aviation Corp.

Uddenberg, Robert Carleton, S.M. in Ae.E.; Project Aerodynamicist GAPA (Supersonic) Project, Boeing Aircraft Co.

Whitman, George Stockbridge, B.S. in Ae.E.; "A" Layout Draftsman, Airframe Section, Engineering Div., The Glenn L. Martin Co.

Elected to Associate Member Grade

Jackson, Eugene B., M.A.; Chief—Library Section, Air Documents Div., Intelligence T-2, A.M.C. (Wright Field).

O'Daly, Patrick P., Superintendent of Airport Maintenance, Aer Lingus Teoranta (Dublin Airport).

Robischon, Robert E., Manager of Advertising and Sales Promotion Department, Intava, Inc.

Sellers, Robert C., Instructor in Aeronautical Subjects, Department Head, University of the State of New York.

Transferred to Associate Member Grade

Agin, James Lester, Chief, Vibration Analysis Sub-Unit, Propeller Lab., War Dept. (Wright Field).

Bissell, Herbert, Field Engineer, Chance Vought Aircraft Div., United Aircraft Corp.

Booker, Richard Armstead, Jr., Designer, ACF-Brill Motors, Inc.

Carr, George Joseph, Aircraft Hydraulic Engineer, Bureau of Aeronautics, U.S. Navy.

Fingerle, Forest Winton, Owner and Operator, Forest Mechanical Engineering Co.

Gung, Simon Fenwick, Sr. Aircraft Draftsman, Engineering Department, The de Havilland Aircraft of Canada, Ltd.

Elected to Technical Member Grade

Boschen, William O., B.S.; Aircraft and Engine Sales, Aviquipo, Inc.

Cochran, Reeves Power, B.S. in Ae.E.; Research Engineer, Aircraft Engine Research Lab., N.A.C.A.

Deitchman, Seymour J., B. of M.E.; Sr. Research Aerodynamicist, Cornell Aeronautical Lab.

Knoeckel, Richard Charles, Jr., Lt. (j.g.), Engineering Officer of Attack Squadron 15 Able, Naval Aviator, U.S. Navy.

McLaughlin, Earl Wilson, B.S.; Lt. Comdr., Naval Aviator, Engineering Duty, U.S. Navy.

Smith, Dudley Burcham, B.S.; Research Engineer "C," Aircraft Research and Development Div., Willys-Overland Motors, Inc.

Tipping, William Victor, Aircraft Weight Engineer, Sir W. G. Armstrong Whitworth Aircraft (England).

Trevisani, Harry Hugo, B.S. in Ae.E.; Chief Engineer, Manufacturer Consulting Service, Inc.

Vaccaro, Robert John, B.Ae.E.; Aerodynamicist, Chance Vought Aircraft Div., United Aircraft Corp.

Wickham, Paul Lester, Jr., B.S.; Field Representative, Aircooled Motors, Inc.

Winzen, Otto C., Head, Aeronautical Research Laboratories, General Mills, Inc.

Transferred from Student to Technical Member Grade

Alyanak, Edward John, Jr., B.S. in Ae.E.; Graduate Student, Rensselaer Polytechnic Inst.

Baron, Judson Richard, B.Ae.E.; Structures Engineer, Chance Vought Aircraft Div., United Aircraft Corp.

Berlin, Edgar David, B.S.; Engineering Asst. "A," Consolidated Vultee Aircraft Corp.

Bond, William Earl Glendening, B.Sc. in M.E.; Engineer, Wind Tunnel Department, Cornell Aero. Lab.

Braunstein, Jules, Ae.E.; Stress Analyst, Piasecki Helicopter Corp.

Chamberlin, Joseph Alan, B.S. in M.E. (Aero); Factory Superintendent, Chamberlin Metal Products.

Chapman, Rowe, Jr., B.S.; Graduate Student and part-time Instructor, Purdue University.

Clapp, David Farwell, B.S.; Engineer, M.I.T.

Cohen, George Herrman, B.S.; Engineering Asst., Consolidated Vultee Aircraft Corp.

Fletcher, John Lester, B.S.; Engineering Draftsman "B," Boeing Aircraft Co.

Georges, Martin Mahlon, Ae.E.; Asst. Stress Analyst, McDonnell Aircraft Corp.

Gerber, John A., B.Sc. in Ae.E.; 1st Lt., U.S.A.A.F.

Gibson, Samuel Weyman, B.Ae.E.; Operations Agent, Eastern Air Lines, Inc.

Goodwin, Roscoe Hooper, B.Sc.; Aeronautical Engineer, Langley Mem. Aero. Lab., N.A.C.A.

Grana, David Charles, B.S. in Ae.E.

Hansen, Herman Ray, B.S.; Engineer Trainee, Chance Vought Aircraft Div., United Aircraft Corp.

Hassell, James Lafayette, Jr., B.S. in M.E. (Aero.); Aeronautical Engineer P-1, N.A.C.A. (LMAL).

Henkels, William Joseph, B.Sc.; Detail Designer, McDonnell Aircraft Corp.

Hermes, Carl Walter, Jr., B.S. in Ae.E.; Engineer-in-Training, Chance Vought Aircraft Div., United Aircraft Corp.

Hittner, Alvin, B.Ae.E.; Stress Analyst, Piasecki Helicopter Corp.

Jacobs, Allan Abraham, B.Ae.E.

Johnson, Paul George, B.Ae.E.; Graduate Student, M.I.T.

Kelly, Edward John, Jr., B.Ae.E.; Engineer, Wright Aeronautical Corp.

Kline, Peter Boyd, B.S. in Ae.E.

Larson, Kenneth Wendell, B.S.

Marstiller, James Keister, S.M.; Analytical Engineer in Rotor Design Group, Bell Aircraft Corp.

Mazourek, Richard Albert.

McJones, Robert Wayne, B.S. in Ae.E.; Graduate Student and Asst. Instructor, Calif. Inst. of Tech.

Nenninger, Paul Fred.

Netherton, Vernon Eugene, B.S.; Layout Draftsman, McDonnell Aircraft Corp.

Niemackl, William E., Jr., Ae.E.; Jr. Engineer, Curtiss-Wright Corp.

Nolte, William Joseph, Jr., B.S.; Engineer Trainee, Chance Vought Aircraft Div., United Aircraft Corp.

Rolfe, Rial Edward, Jr., B.Ae.E.; Asst. Aerodynamicist, McDonnell Aircraft Corp.

Sanders, Robert Hix, Jr., B.S. in Ae.E.; Vibration and Flutter Engineer, McDonnell Aircraft Corp.

Schiff, Jack, B.Ae.E.

Sklar, Norman E., Ae.E.

Specter, Milton Joseph, Ae.E.

Stambler, Irwin, B.Ae.E.

Starr, Thomas, B.Sc.; Stress Analyst, North American Aviation, Inc.

Stoddard, Ray Ladd, B.S.; Rotating Engineer, Marine and Aero. Div., General Electric Co.

Sweeney, Marvin William, Jr., S.B.; Staff Member, M.I.T.

Waugaman, John Arthur, Ae.E.; Graduate Student, Indiana University.

Weihman, Clifford E., M.S.

Wetmore, Kenneth Richard, B.S. in Ae.E.

White, Richard Peregrine, Jr., B.A.E.; Jr. Engineer, Bell Aircraft Corp.

Changes of Address

Since the Post Office Department does not as a rule forward magazines to forwarding addresses, it is important that the Institute be notified of changes in address 30 days in advance of publishing date to ensure receipt of every issue of the *Journal* and *Review*.

Notices should be sent directly to the Institute of the Aeronautical Sciences, 2 East 64th Street, New York 21, N. Y.

Thomas K. Finletter, Chairman of the newly appointed President's Air Policy Commis ion. Other members are: George P. Baker, Vice-Chairman; Palmer Hoyt; Henry Ford, II; and Arthur D. Whiteside. The Director of the Institute is serving as Executive Director for the Commission.

Editorial

Toward Permanent Policy

Of prime importance to everyone in the aeronautical engineering profession was the announcement (July 18) of the appointment of a temporary Air Policy Commission to assist the President of the United States in the formulation of a National policy for the development of aviation. The group has been asked to study "among other pertinent aspects of the problem" such broad questions as "the current and future needs of American aviation, including commercial air transportation and the utilization of aircraft by the armed services; the nature, type, and extent of aircraft and air transportation industries that are desirable or essential to our national security and welfare; methods of encouraging needed developments in the aviation and air transportation industry; and improved organization and procedures of the Government that will assist it in handling aviation matters efficiently and in the public interest."

The directive, and the circumstances that led up to it, are similar to those that existed in 1925 when the Morrow Board was established and again, in 1934, when the Federal Aviation Commission came into being. Both bodies made recommendations that resulted in significant legislation. But the intervening years have brought changes that have rendered their findings obsolete, and the time is now more than ripe for a restatement of our National air objectives. That is the job now facing the President's Air Policy Commission in 1947.

No need to point out here the significance of the President's move. The troubles that are now bedeviling the aircraft manufacturing and air transportation industries cannot be resolved without some clear indication of the course to be followed and the power required to maintain safe flight. In the fog of the postwar years, the industry has been staggering along in increasingly dangerous attitudes, with unreliable instrumentation, with a rapidly dwindling fuel supply—losing altitude—but fast. We can all be thankful that the symptoms have been recognized in time to apply corrective measures before the ultimate crash.

We of the Institute take considerable pride in our participation in this important task. With the permission of the Council, your Director is spending a large part of his time in Washington assisting the Commission in its work. The assignment is temporary and will end on January 1, 1948. Meanwhile, the New York Staff members, individually and collectively, have picked up the extra increment of load so that during this period all the usual services of the Institute will go forward without diminution. S. P. J.

Annual Summer Meeting and Fifteenth Anniversary Dinner

Engineers' Impressions of Papers Read at Institute's Los Angeles Meeting, August 7 and 8, 1947

ELEVEN PAPERS were presented to the more than 600 aeronautical scientists and engineers who attended the Institute's Annual Summer Meeting in Los Angeles, August 7–8. Subjects covered in the four technical sessions included: "Techniques of High Speed Model Testing"; "Progress in High Speed Flight Research"; "Design and Performance Trends"; and "Powerplant and Aircraft Development" in that order, beginning with the morning session on August 7.

Following are impressions of each session as recorded by William H. Statler, Weight Engineer, Lockheed Aircraft Corporation (Morning Session, August 7); Richard Schamberg, Douglas Aircraft Company, Inc. (Afternoon Session, August 7); J. Jonas, Aerodynamics Engineer, Northrop Aircraft, Inc. (Morning Session, August 8); and Dale D. Meyers, Head of Applied Aerodynamics Aerophysics Laboratory, North American Aviation, Inc. (Afternoon Session, August 8).

Sidelights of the Opening Session of the Summer Meeting

by
William H. Statler
Weight Engineer
Lockheed Aircraft Corporation

OUTLINES of recent advancements in predicting the aerodynamic characteristics of high-speed aircraft highlighted the opening session of the I.A.S. Annual Summer Meeting in Los Angeles. Two important research phases, theoretical computation and wind-tunnel testing, were covered by the speakers.

Computation Is Possible

In the realm of pure theory, Dr. Paco Lagerstrom, of the California Institute of Technology, explained the strides that have been made in predicting stability characteristics by determining down-wash and side-wash at any point in the flow field induced by supersonic three-dimensional wings.

Dr. Lagerstrom made a particularly interesting point when he stated that supersonic calculations, in the region of Mach 1.3 to Mach 3, are actually easier than subsonic calculations if the proper approach is taken. The magnitude of the down-wash on the tail of an airplane, for example, can be estimated by first solving the lift problem on the wing and then computing what happens behind the wing. He mentioned that in his opinion the concept of conical flow as introduced by Busemann has been underestimated by researchers in this field.

Calculations have been made for wings of rectangular, trapezoidal, and delta plan forms and reveal that, for a rectangular wing with an upwash of -1, the upwash at infinite distance behind the wing is in the magnitude of about -0.65. However, infinity in this application is

theoretical only, for viscosity reduces the value to four or five chord lengths for practical calculations.

Testing Necessary

As a particularly interesting climax, Dr. Lagerstrom cautioned against the testing of a multitude of wing plan forms in an attempt to substantiate his calculations or to serve as a basis for future predictions. He did, instead, recommend the thorough testing of a few basic types in order to substantiate the *trend* of the theoretical results. Postsession discussions indicated that wind-tunnel experts are in hearty agreement with this recommendation.

Dr. Lagerstrom further suggested that the testing be done in supersonic tunnels with straight flow, but in this vein Dr. Kent, of the Ballistics Laboratory, interjected the comment that actual tests made by his staff gave results that agreed very closely with the theoretical results obtained by Dr. Lagerstrom, even though a straight-flow tunnel was not used.

To most of the engineers present, this was evidence enough that Dr. Lagerstrom is on the right track and that theoretical work, substantiated by a relatively small amount of tunnel testing, can at times prove to be the most economical approach to the solution of the problem at hand.

Dr. Lagerstrom's presentation left the audience with the impression that the purely theoretical approach is not so difficult as one might think, and it became apparent that the real problem exists in attempting to substantiate our theoretical results with actual tunnel test results. This substantiation may be just out of reach for the moment, since we at present have no supersonic tunnel suitable for the purpose.

Solution Approached

One of the most recent attempts at the solution of the latter problem was explained by John H. Weaver, of Lockheed, in his discussion of a method for increasing tunnel velocities by installing a streamlined bump in the tunnel floor at the test section to create a venturi effect. Although on the face of it this again seems to refute Dr. Lagerstrom's recommendation for straight-flow tunnels, Mr. Weaver pointed out that the flow over the top of the bump in the vicinity of the model was not curved enough to cause noticeable inaccuracies. The small half models used are mounted on a relatively flat spot on the bump contour, and the slight curvature of the streamlines at this point has little if any effect on the results.

Following Mr. Weaver's description of the bump and the testing technique applied, questions were raised pertaining to the problems encountered in protruding such an obstruction into a high-velocity air stream. It was pointed out that two obvious difficulties, shock waves on the forward portion of the bump and separation on the aft portion, had not really been so serious as one might imagine. The slight separation that occurs on

Morning Session, August 7, opened with introductory remarks by Chairman A. E. Puckett.

the aft portion of the bump downstream from the model is not upsetting because the model is relatively small compared to the chord of the bump. However, small shock waves occurring on the forward portion of the bump present more of a problem. It is believed that these may be caused by leakage or small structural deflections at Mach Numbers exceeding 1.05 and could therefore eventually be almost entirely eliminated. Apparently, these shocks are responsible for vibrations that occur at the higher Mach Numbers during the tests.

In spite of these problems, the accuracy of the procedure is amazing, for, as Mr. Weaver pointed out, tests have been repeated with the results agreeing within about 2 per cent.

Representatives of the N.A.C.A. Laboratory stated that their organization has considered similar experiments in recent months but that they are handicapped since their tunnels have circular throats. This complicates the bump installation to a large degree.

Following Mr. Weaver's presentation, C. L. Johnson, of Lockheed, announced that arrangements have been made for other researchers to use the Lockheed bump for their own experiments. This represents an important step in eliminating experimental duplication of effort on the part of other researchers with similar problems.

New Problems—New Techniques

Dr. Clark B. Millikan, of the California Institute of Technology, elaborated on the new problems that have arisen in the Southern California Cooperative Wind Tunnel since the advent of the bump testing idea. One problem of particular importance was that of adapting the very high capacity balances in the tunnel to the small bump models, which have only about 1 sq.ft. of area.

The size of the models employed causes additional problems of model flutter and elastic deflections. In the course of the discussion of these problems, it was pointed out by Boeing representatives that, although they have problems of a similar nature in similar testing procedures, the problems are magnified because the Boeing models are only about half as large as those used by Dr. Millikan.

It was pointed out that the researcher must first *prove* that he is not in trouble before he can safely assume that he is not.

Dr. Millikan described the new testing techniques that are being employed to solve the new problems that have arisen.

The session as a whole left the impression that gains of appreciable magnitude are being made in both the application of pure theory and in testing technique and that an intelligent application of a combination of these two research phases can expedite the solution of many of the current supersonic problems.

Review of Afternoon Session, August 7, 1947

by

Richard Schamberg
Douglas Aircraft Company, Inc.

CHAIRMAN SMITH J. DE FRANCE, Engineer-in-Charge, Ames Aeronautical Laboratory (N.A.C.A.), opened the second technical session by pointing out that both the methods of wind-tunnel model testing and direct flight testing are complementary phases of "Progress in High Speed Flight Research," truly the topic of the entire day. Of the three papers on the agenda, the first two were concerned with instrumentation problems, whereas the last paper dealt with the design and testing of a piloted high-speed aircraft.

The first paper, entitled "Instrumentation of Guided Missiles: Applications and Limitations," prepared by

Lt. Gen. Ira C. Eaker, former Deputy Commander and Chief of A Staff, A.A.F., was guest speaker at the August 7 Luncheon.

Lester G. Zukerman, of the Hughes Aircraft Company, was read by the author's associate, J. P. Dallas. Mr. Zukerman was concerned with the instrumentation required for the flight testing necessary to establish a missile's proper behavior as a pilotless aircraft rather than with those instruments that perform the functions of guidance and control. A distinction was made between "external" and "internal" instrumentation. The former, which includes optical and electronic means of observing the position, orientation, and overall performance of a missile from an external ground or air station, was not considered further. Internal instrumentation determines general performance parameters, such as missile attitude and accelerations, ambient pressure, and temperature, in addition to such quantities as rate of response of control surfaces, stresses and temperatures of critical components, by means of instruments carried aboard the missile.

Zukerman pointed out that photographic recording equipment, commonly employed in flight testing of piloted aircraft, is less suitable for use in small missiles because of excessive weight and volume of the cameras, their limited rate of response, and uncertainty of recovery of the films. Instead, radio telemetering was recommended as a more appropriate means of transmitting vital information from the missile to ground observation stations. Various types of "transducers," such as strain gages and thermocouples, were mentioned as available means of transforming mechanical quantities into electrical impulses. Zukerman next explained the features and limitations of several methods of "multiplexing," whereby many individual messages may be transmitted by means of a single carrier. An analysis of the space requirements of the various components of a telemetering transmission unit revealed that a total volume of 300 cu.in., which may be distributed conveniently throughout the missile, suffices for a typical installation. Mr. Dallas especially emphasized the author's concluding remarks that an unsuccessful flight is of the greatest importance, provided that the internal instrumentation yields sufficient reliable information to establish the exact cause of the failure.

During the brief discussion of Mr. Zukerman's paper in the nature of detailed questions directed to Mr. Dallas, the latter expressed the opinion that the accuracy obtainable by telemetering equalled that of remote-control schemes generally.

Chairman de France called on Dr. L. A. Delsasso, of the Ballistics Research Laboratories (Aberdeen Proving Grounds), to present the second paper, entitled "Full-Scale Free-Flight Ballistic Measurements," prepared jointly by L. A. Delsasso, A. L. G. Bey, and D. Reuyl. This paper dealt with the more recent developments in the optical and electronic methods of observing the flight of high-altitude missiles from ground-observation stations—that is, by means of "external instrumentation" as defined by Mr. Zukerman.

Dr. Delsasso first used numerous slides to supplement his vivid and humorous description of a variety of optical instruments in use for the determination of the position, altitude, velocity, and acceleration of high-altitude missiles. The first group of instruments represents the adaption of devices developed for other purposes during the last War, notably the Mitchel and Askenia theodelites, the Bowen-Knapp high-speed camera, and the Ballistic camera, the last possessing an accuracy of 1/200 mil in the determination of position. Particularly impressive was a series of tracking telescopes developed especially for the observation of missiles. The largest of these telescopes, using a 36-in. mirror, is capable of following a V-2 type missile to the zenith of its trajectory under the favorable atmospheric conditions prevailing in New Mexico. Dr. Delsasso stressed the importance of utilizing atmospheric conditions to the best advantage in the selection and design of equipment for optical tracking.

Chairman Smith J. de France opens Afternoon Session, August 7.

The standard radar beam and the radio-Doppler method were considered as the most important examples of the electronic methods of instrumentation. The radio-Doppler method, capable of determining position, velocity, and acceleration of a missile with great precision, was described in some detail, including the layout of ground stations and the type and evaluation of the records that are obtained.

In concluding, Dr. Delsasso emphasized two important points: (1) Because of the great expense involved in the construction and testing of a single high-altitude missile, an overdetermination of data by several independent methods is desirable in order to ensure successful measurements. (2) The type and location of electronic flight test equipment, such as antennas, should be decided on before the detail engineering design of a missile is begun.

In response to questions from the audience, Dr. Delsasso revealed that the use of special color films and the effects of several diffraction phenomena are being investigated at present. Dr. Delsasso also expressed

Al Lombard *(right)*, Chairman of August 8 Morning Session, discusses a point with Phil Colman, Chief Aerodynamics Engineer, Lockheed Aircraft Corporation, and Willis M. Hawkins, Chairman, Program Committee.

the opinion that future improvement in the accuracy obtainable with the radio-Doppler method would require a more precise remeasurement of the speed of light.

The last paper, "Development of the XS-1 Supersonic Research Airplane," by Robert M. Stanley and R. J. Sandstrom, Bell Aircraft Corporation, was presented by Mr. Stanley, Vice-President—Engineering, of this company. Mr. Stanley first reviewed the history of the XS-1, which was envisioned during the late War as a research vehicle intended to "prove or disprove conclusively the feasibility of supersonic flight with aircraft having a conventional aerodynamic configuration." The basic design features were illustrated most effectively by means of a color motion picture, which also contained spectacular scenes showing the firing of the XS-1 four-unit rocket motor, delivering 6,000 lbs. of thrust, and the launching of the XS-1 from its B-29 mother airplane, during successful test flights.

Following the motion picture, Mr. Stanley discussed the engineering considerations that led to the selection and design of the rocket power plant, rocket fuel, launching mechanism, and cockpit pressurization. Unusual problems encountered in the development of a liquid nitrogen evaporator, which produces gaseous nitrogen at 5,000 lbs. per sq.in. pressure, were of particular interest.

The XS-1 was equipped with flight-testing instrumentation designed to record pressure and stress distributions encountered in the transonic and supersonic speed ranges. Standard types of pressure orifices and strain gages were connected to automatic recording equipment. A minimum amount of telemetering equipment was included to yield some information in case of total loss of the aircraft.

Mr. Stanley concluded his interesting paper with an outline of XS-1's proposed future flight-test program, which is designed to allow the pilot to approach, and, if sucessful, exceed, the speed of sound in small increments. For maximum pilot safety, the critical speed range is to be explored initially at high altitudes with the aircraft in a climbing attitude. This test program was also considered from the point of view of pilot psychology, both in Mr. Stanley's paper and the brief ensuing discussion.

Chairman Smith J. de France expressed the audience's appreciation of the efforts of the three speakers and of their presentation of the progress made in the several phases of high-speed flight research, before turning the meeting back to Program Chairman Willis Hawkins who adjourned the session.

Highlights of the Morning Session, August 8, 1947

by

J. Jonas

Aerodynamics Engineer
Northrop Aircraft, Inc.

WILLIS M. HAWKINS, Chief Preliminary Design Engineer, Lockheed, and Program Chairman of the Annual Summer Meeting, opened the morning session, which was to be devoted to "Design and Performance Trends."

As Mr. Hawkins so aptly put it, the main emphasis of present-day commercial aircraft has shifted from its infancy "Will it fly?" to the present-day "How much pay load will it carry; at what unit cost will it carry the pay load; what comfort will it afford its passengers?" These and other questions certainly reflected a greatly improved analytical approach of today's designer. Mr. Hawkins cited the 5-cent seat-mile charged on our domestic airlines as an example of improved operating efficiency.

Mr. Hawkins then introduced the Chairman for the morning session, A. E. Lombard, Jr., Engineering Consultant, Consolidated Vultee Aircraft Corporation.

Philip A. Colman, Chief Aerodynamics Engineer, Lockheed Aircraft Corporation, was then called upon to present the first paper of the morning session: "Analysis for Optimum Transport Airplane Configuration."

This paper presented a generalized study evaluating the sizes, types, and utility of cargo airplanes designed for cruising speeds from 325 to 475 m.p.h. for pay loads from 20,000 to 100,000 lbs. and for ranges of 1,500 and 3,000 miles. Power-plant installations considered were of the internal combustion engine with turbosupercharger type, the turbojet type, and the propeller-jet type.

Generalized studies of this type require by necessity a large number of assumptions. Generalizations derived from the results then become only as good as the original assumptions made.

Using current engine performance data, Mr. Colman transiated his assumptions into analytical expressions. He concluded that the turbojet engine is superior for the highest speed, short-range operation for any pay

Greetings to Founder

On the occasion of the Fifteenth Anniversary Dinner, celebrated August 9 during the Annual Summer Meeting in Los Angeles, President Preston R. Bassett, of I.A.S., dispatched a telegram of greetings and congratulations to Major Lester D. Gardner, founder and builder of the Institute, as follows:

"The Council, officers, members, and guests of the Institute of Aeronautical Sciences assembled for the Fifteenth Anniversary Dinner at the Annual Summer Meeting send greetings to you as founder and builder of the Institute. We congratulate you on the honor (1947 Guggenheim Medal) you have recently received. All join in best wishes for your health and happiness in your well-earned retirement."

(Signed) P. R. Bassett

load. The turbopropeller installation was considered as superior for all other conditions.

Using essentially the standard method outlined by the Air Transport Association, the utility of the airplanes thus derived was compared. It was concluded that the small pay-load airplane is the most efficient in work done per unit cost. Airplanes designed to carry the larger pay loads become more efficient at higher speeds. Conversely, small pay-load, fast airplanes are as efficient as large pay-load, slow airplanes.

This part of the paper appeared to be even more susceptible to the validity of the basic assumptions made. The utilization time per day of an aircraft must be to a large extent a function of the service time required to keep it airworthy. In this connection it might be worth while to remember that the replacement of a washer in both a large and small craft will cost only 5 cents as far as the washer is concerned, but the time loss incurred will certainly cause a much larger revenue loss in the case of the large aircraft. At that, the trouble rate of incidence will be larger on a larger aircraft. Thus, the assumption of a constant utilization time of 10 hours per day for all aircraft, small and large alike, as made by Mr. Colman might bear some amplification.

In the ensuing discussion Ken Warren, of Consolidated Vultee Aircraft Corporation, contended that some assumptions made by Mr. Colman deserve some analysis. For instance, he disagreed somewhat with the assumption that the product of power and wing loading may be taken as a constant value. He rather felt that the value of this product should be a function of the number of engines, the variation probably being a linear one. He also disagreed with the assumption of a constant value of wing loading regardless of speed. He felt that the higher speeds with inherently higher gust loadings would necessitate different wing loadings. Mr. Colman concluded then that, unless the number of variables is kept to a minimum, the work involved becomes prohibitive.

The next paper presented was well placed, coming after Mr. Colman's paper, for R. S. Shevell, Performance Engineer, Douglas Aircraft, concerned himself with "Operational Aerodynamics of High Speed Aerodynamics." By implication this branch of aerodynamics deals with the study of the optimum use of an airplane's performance ability. Conceding that lowest cost per passenger-mile is usually the chief objective, Mr. Shevell nevertheless contended that other less tangible characteristics must be considered as well. He listed as typical characteristics ride roughness, rate of descent, and the effect of speed on traffic appeal; all features pertaining to passenger comfort; and in the final analysis—are we mercenary?—to increased revenues. Various operational parameters, such as power used during the entire flight path, were presented indicating their effects upon operating cost and passenger comfort.

Mr. Shevell concluded that, for both conventionally powered and turbojet-powered aircraft, maximum economy is obtained by climbing rapidly, cruising at high altitude, and using as much power as practicable.

Mr. Lombard opened the discussion suggesting that the ride roughness should be considered as unacceptable when the gust loads induce sufficient negative g loads to make the passenger's coffee leave the tray. That may not be a designer's criteria but that is exactly how the passenger feels.

I. L. Ashkenas, Chief Aerodynamics Engineer, Northrop Aircraft, felt that the assumption made by Mr. Shevell—namely, that the reserve fuel to be carried by jet aircraft should amount to 13 per cent of the zero fuel weight if burnt at high altitude and 34 per cent if burnt at 10,000 ft.—was a bit pessimistic. Mr. Ashkenas further believed that gust frequencies at high altitude were lower than at lower altitude and suggested that this might be taken into account in determining ride-roughness factors.

M. A. Garbell presented some data showing the effect of altitude, gust frequency, and anoxia on passenger comfort. He indicated that test results showed that six times as many passengers became ill at 18,000 ft. as at 10,000 ft. altitude.

Clearly passenger comfort is still a wide open field.

W. F. Ballhaus, Structures Engineer, Douglas Aircraft, presented the last paper of the morning session: "Parameters Affecting Aircraft Weight." In a refreshingly simple presentation, Mr. Ballhaus stressed the importance of the statistical approach toward the weight estimate problem, particularly as an aid to the preliminary design engineer. Using Gauss Error Function he arrived at encouragingly low margins of error.

It was later brought out that Bill Martin, of North American, had conducted a similar investigation with equally promising results.

A. E. Raymond *(center)*, Vice-President—Engineering, Douglas Aircraft Company, Inc., and Chairman of August 8 Afternoon Session, talks over the meeting with John K. Northrop *(left)* and M. U. Clauser.

Mr. Hawkins then adjouned the meeting after making an announcement about a projected trip to the Caltech wind tunnel and to the Aerojet Corporation.

Afternoon Session, August 8, 1947

by

Dale D. Myers
Head of Applied Aerodynamics
Aerophysics Laboratory
North American Aviation, Inc.

FOR THE AFTERNOON MEETING, the theater was not filled to capacity, although it had been expected that the largest attendance would be for this session. Probably the reason for the somewhat lower than capacity crowd was the weather. It never rains in Los Angeles in August—but it rained that morning, and, to top it all off, the temperature cruised around 90° all day. The temperature, combined with Washington, D.C., humidity, definitely made it a "coats off" meeting and probably turned the tide in answering many persons questons as to comfort (at home, beach, or air-conditioned office) vs. an interesting (but hot) afternoon listening to two of the outstanding men in the aviation industry.

Dr. Arthur E. Raymond, Vice-President (Engineering) of Douglas and Past-President of the Institute got the meeting off to a good start by taking off his coat.

After a brief introduction, he turned the meeting over to Dr. Milton U. Clauser for his paper, "Trends in Aircraft Power Plants."

In Dr. Clauser's opening statements, he likened himself somewhat to a medium in trying to foresee the future development of power plants, but it was obvious from his paper that the prophecies contained in it were based on a careful study of present and past trends and not on crystal ball meditations.

Trends in Aircraft Power Plants

Dr. Clauser and his associates had made a thorough study of available references on past engine performance and, by use of the growth and cyclic trends used by economists and biologists, had predicted the near future and distant future development rates for all known types of aircraft power plants. By correcting supercharged engine performance to an equivalent sea-level brake horsepower and by determining an equivalent brake horsepower for jet engines with an assumed propeller efficiency of 85 per cent, he was able to plot a single curve of equivalent sea-level horsepower vs. time on a semilog scale, which showed a definite basic trend line. Although the first and second World Wars showed an accelerated pace in development, the years following World War I showed a decline in progress back to the basic development line. A similar trend seems likely now. This result is substantiated in most economic cycle studies, where wars only momentarily disturb the basic period and amplitude of the cycles.

In the speed of the airplanes, the rate of progress during World War II was masked by compressibility drag increases, which absorbed the rapid increases in equivalent sea-level brake horsepower. (After supersonic flight is attained, the addition of wave drag and additional weight for refrigeration should further decrease the rate of increase of speed with time.)

After analyzing the factors contributing to the final airplane performance, such as specific fuel consumption, brake horsepower per pound, and the period between major overhauls, Dr. Clauser predicted the future development of reciprocating and jet engines based on past development. In addition, based on industrial cycles that started with the industrial revolution, he predicted the distant future development of rockets, ram-jets, and atomic power propulsion. It is interesting to note that he concluded that the reciprocating engine will probably reach maturity about 1970, 10 years after his prediction of the beginning of the rapid development of atomic power in 1960. All other forms of propulsion known today are also expected to be rapidly decreasing in rate of progress at about the same time. (According to economic cycle analysts, 1960 is in the upswing of the third cycle following the beginning of the industrial revolution.)

Discussion

There was no discussion of this interesting paper, probably because of the heat, and because the field was so well covered by Dr. Clauser. (I am surprised that someone did not bring in the discussion of the thrust horsepower of rockets, which would not in any way fit the curves Dr. Clauser presented. The maximum thrust horsepower of the German V-2 was on the order of 500,000. A better parameter for fitting rocket, ram-jet and turbojet performance to one curve might have been maximum thrust divided by fuel consumption.)

The Development of All-Wing Aircraft

Following a brief recess, Dr. Raymond introduced a man who needed no introduction: Jack Northrop. Mr. Northrop repeated his Wright Brothers lecture given before the Royal Aeronautical Society in London.

Mr. Northrop opened by stating the requirements for satisfactory use of all-wing aircraft. The airplane must be relatively large to enable the designer to use efficiently the volume inside the wing, and the final design must satisfy stability and controllability requirements.

Neglecting compressibility effects, Mr. Northrop first presented a basic performance analysis, showing the relative performance advantage of the all-wing type over the conventional airplane with the same gross weight and wing span. If take-off requirements govern, the all-wing type has a complete advantage, since minimum drag is on the order of one-half that of the conventional airplane. If landing conditions govern, the all-wing type loses some of its advantage because of the somewhat lower trimmed maximum lift coefficient. In his comparison study, it was pointed out that the all-wing airplane would have 30 to 58 per cent more range and a 15 to 25 per cent increase in speed (remember that compressibility effects have not been considered).

Discussing the stability and controllability, Mr. Northrop stated that, although center-of-gravity travel must be restricted, it was easy to hold c.g. travel to 4 or 5 per cent M.A.C. on all-wing designs. Control must be done by irreversible systems, since wing trailing-edge flow separation caused erratic hinge moments, and thus stick-free stability was unsatisfactory.

Dynamic stability parameters were compared with those of conventional designs, and it was pointed out that, although almost all the parameters (except C_{l_p}) were much lower than usual, the dynamic stability in cruising is satisfactory. At high lift coefficients, the usual occurrence for sweptback wings is felt—namely, a marked increase in C_{l_β}, resulting in oscillatory instability. One other disadvantage from a controllability standpoint was the low value of C_{y_β}, which caused a lack of banking necessary to correct sideslip.

The paper was concluded with a short motion picture showing the various Northrop wings, ending with some beautiful shots of the XB-35. (Incidentally, the view of those wings from the side *could* be mistaken for flying disks.)

Discussion

A. E. Lombard (Convair) asked about operation with asymmetric power. Mr. Northrop said that instead of attempting to trim to zero yaw with the drag rudders, the airplane is flown in a yawed (20°) attitude. In conventional types, the drag rise at yaw is too large to permit yawed flight, but for the all-wing type the drag rise at yaw is small, so yawed flight is allowable (no mention of landing with one engine out was made).

The meeting was then adjourned.

I.A.S. National Meeting Schedule

Wright Brothers Lecture— Washington, D.C.—December 17, 1947

Sixteenth Annual Meeting—New York—January 27–29, 1948

Members or organizations wishing to submit papers for presentation at National Meetings should send outlines or summaries to the Committee at least 3 months prior to the meeting.

All papers submitted will be considered for publication in the *Journal of the Aeronautical Sciences* or the *Aeronautical Engineering Review.*

All correspondence should be addressed to The Meetings Committee, Institute of the Aeronautical Sciences, 2 East 64th Street, New York 21, N.Y.

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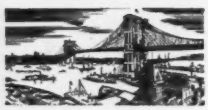

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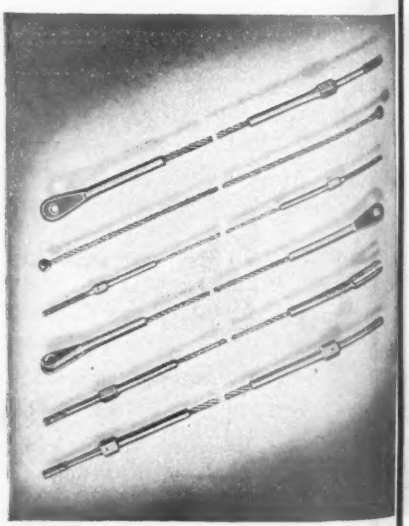

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I.A.S. Briefs

Summaries of current papers received for publication or presentation at I. A. S. meetings

This Section gives advance and current information on papers presented to the Institute for publication or for presentation at meetings. Summaries of all pertinent papers, including those given at Section and Student Branch meetings, are published each month in these columns as rapidly as they are received from authors. All papers summarized in this issue were presented at the Annual Summer Meeting in Los Angeles.

Many of these papers, after being processed by the Editorial Committee in the usual manner, will appear in full in later issues of the JOURNAL *or* REVIEW.

Some specialized papers will be made available through the Sherman M. Fairchild Publication Fund. For detailed information regarding papers immediately available, *see page 27.*

High-Speed Testing in the Southern California Cooperative Wind Tunnel

By

C. B. Millikan, J. E. Smith, and R. W. Bell
California Institute of Technology

The basic performance and flow characteristics of this variable density, high-subsonic-speed wind tunnel are described. The problems of model support and of special mounting systems for wind-tunnel tests at Mach Numbers close to one are discussed in detail. In particular, the Lockheed "Bump" method of testing through the transonic region in a wind tunnel is considered. Calibration, operation, and data reduction procedures required for obtaining and interpreting experimental data at Mach Numbers near one are discussed, especially the effects of compressibility on blocking and other tunnel-wall corrections. Pertinent experimental results from a number of recent tests are presented.

Down-Wash and Side-Wash Problems in Supersonic Wing Theory

By

Paco Lagerstrom
California Institute of Technology

The work reported on was done at Douglas Aircraft, Santa Monica, in collaboration with Martha Graham and the Jet Propulsion Laboratory, California Institute of Technology. The results are contained in a Douglas Report SM 13007 and in a J.P.L. report to be published soon.

Methods are developed for determining the down-wash and side-wash at any point in the flow field induced by supersonic three-dimensional wings. These methods are applicable to a large class of wings, and calculations have been carried out for trapezoidal and rectangular wings. Special simplified methods for determining the flow field at large distances behind the wing ("infinity") are developed. These have been applied to the wings mentioned above and to delta wings.

The methods differ radically from those used in subsonic flow and rely heavily on the concept of conical flow as introduced by Busemann. First the problem of pressure distribution on the wing has to be solved. This can be done by conical methods for most wings of practical interest. Then conditions behind the wing are obtained from the principle of "cancellation of lift." In the simplified method side-wash at the trailing edge is determined directly from conditions on the wing and this easily gives the flow field at infinity. To obtain a more detailed picture of the flow field closer to the wing certain "conical" wings of constant lift distribution are used. For example, the entire flow field induced by a rectangular wing may be obtained by starting from the Busemann solution for a lifting quadrant and then superimposing behind the trailing edge infinitely many wings of constant lift distribution.

Solutions for conditions at infinity and the complete solution for certain trapezoidal wings are obtained in closed form. In other cases numerical methods have been developed. Further experimental and theoretical research is discussed.

Full-Scale Free-Flight Ballistic Measurements

By

L. A. Delsasso, A. L. G. de Bey, and D. Reuyl
Aberdeen Proving Ground

Special problems arising in the instrumentation of full-scale free-flight tests are considered, particularly as pertaining to guided missiles. Applications of specialized optical and electronic equipment are considered in detail.

Under optical instrumentation such problems as the modification and application of acceleration cameras, photo-

theodolites, and precision-plate cameras are discussed. In addition, the development of tracking telescopes using refractors and reflectors of large effective focal length in conjunction with special mounts for studying the behavior of missiles during the entire flight is discussed; results obtained so far from these instruments are considered. Brief consideration is given to the methods for determining ballistic data, by means of high-speed motion-picture cameras, for aircraft rockets launched from airplanes.

Under electronic instrumentation the use of radar for trajectory determinations and the modifications necessary on standard radar equipment for use in long-range guided missiles are discussed. The use of radio-doppler and the application to this field are considered in detail, and the problems and advantages encountered in this field are presented. The usefulness of microwave reflection doppler equipment is also reviewed. Finally, a comparison of the results obtained by the various systems of instrumentation is made.

A Method of Wind-Tunnel Testing Through the Transonic Range

By
John H. Weaver
Lockheed Aircraft Corporation

Wind-tunnel testing by conventional methods in the so-called transonic range is extremely difficult and unreliable because of the blocking phenomenon between the model and the tunnel walls. This paper outlines a method of modifying existing high-speed wind-tunnel test sections with a suitably contoured bump on which reflection plane models can be satisfactorily tested through the speed of sound. The method depends upon the establishment of a local high-velocity region over the bump in which half-models mounted vertically can be tested. Experimental data on several models tested by this method are presented, together with typical velocity distributions over the bump contour.

The results of the tests made to date appear to be reliable and the method offers a means of obtaining rapidly, and at moderate costs, large amounts of aerodynamic data in the all-important region near $M = 1.0$.

Instrumentation of Guided Missiles; Applications and Limitations

By
Lester G. Zukerman
Hughes Aircraft Company

Flight testing of small guided missiles imposes instrumentation problems that cannot be satisfied by methods ordinarily used in conventional aircraft. Instruments designed for use in conventional aircraft are excessively bulky and many times will not respond to the relatively high resonant frequencies encountered in unstable flight of small bodies. Under such conditions, even ordinary motion picture cameras cannot record the violent and rapid oscillations of the missile or its control elements; yet this information is required in order to design proper stabilizing units.

Recovery of recorders carried within the missile is never assured, whether they be heavily armored, or released on a parachute. While such methods have proved useful, more reliable means of gathering data are desirable. It has been felt that radio telemetering has certain advantages in this application, but to be useful, the air-borne system must be small, rugged, and simple. To this end, several systems are in use, and many more are under development. There is no one system applicable to all guided missiles, but the requirements of a particular missile usually point to a few methods of telemetering which appear to be most suitable. Judgment is generally based on the size and range of the missile, its stability characteristics, the number and type of parameters subject to study, the duration of flight, the type of launching, and the accelerations to which it will be subjected. These things determine the design of the gages, the number of channels, the type of multiplexing, and the number and locations of the receiving stations.

Development of the XS-1 Supersonic Research Airplane

By
Robert M. Stanley and R. J. Sandstrom
Bell Aircraft Corporation

Constructed primarily as a research vehicle by Bell Aircraft Corporation, the XS-1 has now undergone sufficient flight testing to prove the practical value of this method of approach to the problems of transonic and supersonic flight. Equipped with a rocket motor producing 6,000 lbs. of thrust and a sealed pressurized cabin, satisfactory operation is possible irrespective of atmospheric density. Recognition of the impossibility of accurately predicting either the leading distributions or the occurrence and intensity of possible buffeting in the transonic range resulted in the airplane being designed to withstand 18g ultimate. Completely instrumented, with more than 400 pressure orifices and strain gages that provide a complete chronological history of flight loads and distributions, the XS-1 can prove or disprove conclusively the feasibility of supersonic flight with aircraft of conventional aerodynamic configuration.

Analysis for Optimum Transport Airplane Configuration

By
Philip A. Colman
Lockheed Aircraft Corporation

A generalized study determines the sizes, types, and utility of cargo airplanes designed for cruising speeds from 325 to 475 m.p.h., for pay loads from 20,000 to 100,000 lbs. and for ranges of 1,500 and 3,000 miles. It is shown that the turbine-jet engine is superior for the highest speed, short-range operation for any pay load. The turbine-propeller engine is superior for all other conditions. A pay load of 100,000 lbs. cannot be carried 3,000 miles at 475 m.p.h. with engines that will be available in the near future.

Comparing the utility of the airplanes derived, the small pay-load airplane is the most efficient in work done per unit cost. However, although the efficiency of the small pay-load airplane reduces with increased speed, airplanes designed to carry the larger pay loads have an optimum efficiency at the

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higher speeds. A small pay-load, fast airplane is as efficient as a large pay-load, slow airplane. Choice of other parameters results in other conclusions.

Operational Aerodynamics of High-Speed Transport Aircraft

By

R. S. Shevell

Douglas Aircraft Company, Inc.

Operational aerodynamics is the study of the optimum use of an airplane's performance capabilities. Although obtaining the lowest cost per passenger-mile is usually the chief objective, other less tangible characteristics must also be considered. Typical of these characteristics, which may be incapable of specific evaluation but which are nevertheless important, are ride roughness, rate of descent, and the effect of speed on traffic appeal.

A study of the effects of various operational parameters, such as the power used in climb, cruise, and descent, cruising altitude, and rate of descent, upon operating cost, block speed, and ride roughness was made on airplanes representative of the past, present, and future in transport aircraft. The airplanes selected were the Douglas DC-3, the DC-6, and an airplane of about the size of the DC-6 powered with turbojet engines. Costs and block speeds of various types of operation are compared for typical ranges for each airplane while a more detailed investigation is made for the jet airplane.

The general results indicate that best economy and highest block speeds are obtained for all three types of airplanes by climbing rapidly, cruising at a high altitude, and using as much power as is practicable. A rapid descent is desirable for speed and economy although this may be restricted by considerations of ride roughness. Higher altitude is also desirable to minimize ride roughness.

The magnitude of the effects of selecting the power, rate of climb, altitude, and rate of descent on speed and cost is shown to be moderate with conventionally powered airplanes and to increase when the range of possible conditions is enlarged, such as when supercharged cabins permit higher altitude operation. The introduction of gas-turbine engines, however, makes the proper selection of the operational variables so important that the problem changes from one of seeking small improvements to attain optimum operation to that of making airline operation practicable at all. The particular operating characteristics of turbojet-powered airplanes which make these items critical are discussed and analyzed.

Parameters Affecting Aircraft Weight

By

William F. Ballhaus

California Institute of Technology

A number of single-engined conventional landplanes are studied to determine the possibility of applying probability theory to the problem of weight estimation. The eventual goal is the development of usable weight-estimating formulas for aircraft of all types. It is assumed that if such formulas can be developed for the simplest types of aircraft, they may possibly be developed for more complicated types. It is further assumed that if nothing can be developed for the simplest types, then certainly no results can be obtained for complicated ones. The effects of aerodynamic and geometric parameters upon aircraft weight are considered for each of the important airplane components.

The results of the study are encouraging and in many instances are exceptionally good. The underlying limitations to the applicability and generality of the study which are pointed out are due only to the lack of sufficient data. Although this study was initiated with the idea of developing estimating formulas for use in preliminary design, the results are so much better than expected that they can be used as a basis for actual working weight estimates.

Trends in Aircraft Power Plants

By

Milton Clauser

Douglas Aircraft Company, Inc.

The aircraft designer who is interested in long-range planning must be able to understand and predict the performance that he should be able to expect from the power plants that he will use. With the advent of the new forms of power plants this problem is becoming more interesting and more complex.

By studying our past progress some significant trends and relations between the different propulsion units are obtained. In some ways turbojet and propeller-turbine engines represent an extension of the reciprocating engine development but in other ways show a marked departure. By analytically extrapolating our progress, some predictions and warnings as to our future course may be made. A look into the more distant future also reveals interesting possibilities.

The Development of All-Wing Aircraft

By

John K. Northrop

Northrop Aircraft, Inc.

Detailed performance comparisons between all-wing and conventional aircraft are given, showing wherein the former has advantages over the latter, not only from the aerodynamic point of view but also from the standpoint of simplicity of construction and weight reduction.

A complete résumé of designs successfully flown to date by the Northrop company is presented, ranging from a 29-ft. "buzz bomb" to the 172-ft. B-35, two of which are currently undergoing tests for the Army Air Forces. An examination of stability and control problems is included, together with an estimate of further performance improvements to be expected in the near future.

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Aeronautical Reviews

Acoustics

Effect of Distance on Airplane Noise. Arthur A. Regier. *U.S., N.A.C.A., Technical Note No. 1353,* June, 1947. 19 pp., figs. 9 references.

If the greater absorption of sound at the high frequencies and the insensitivity of the human ear to the low frequencies are considered, at distances greater than one mile from the source the sounds in a frequency range between 500 and 1,000 cycles are found to be loudest. At shorter distances the higher frequencies will be loudest. Data obtained with a light trainer airplane flying at various altitudes up to 5,000 ft. show good agreement with the inverse square law when it is assumed that there is no atmospheric absorption and that the sound energy from the airplane is constant. The increase of sound output of the propeller with altitude may balance the atmospheric absorption under certain conditions.

A New Method of Representing Harmonic Analysis and a New Mechanical Curve Analyser. Martin Grutzmacher. (*Akustische Zeitschrift,* Vol. 8, No. 2, March, 1943, pp. 49–63.) *Gt. Brit. Ministry of Supply, R.T.P. Translation No. 2585.* 20 pp., illus. 13 references. Durand Reprinting Committee, California Institute of Technology, Pasadena. $1.00.

The curve to be analyzed is resolved into individual rectangular impulses, the spectra of which consist of harmonics of equal amplitudes and phases. To determine the harmonics of the complete sequence of curves, the associated harmonics of the same ordinal number are added vectorially, and the harmonics are then constructed graphically according to amplitude and phase. The graphical construction of harmonics is carried out for a number of simple functions. A device is described which carries out the graphical construction automatically. A sequence of curves drawn on a tape is passed over a roller and a pointer is made to follow the curves. The motion of the roller rotates a blank paper in such a way that the stylus operated by the pointer traces the harmonic on it directly and gives its phase and amplitude.

Aerodynamics

Down-Wash and Side-Wash Problems in Supersonic Wing Theory. Paco Lagerstrom. *California Institute of Technology.* (For abstract see "I.A.S. Briefs" on page 28 of this issue, September, 1947.)

A Method for Calculating Airfoil Sections from Specifications on the Pressure Distributions. Glenn H. Peebles. *Journal of the Aeronautical Sciences,* Vol. 14, No. 8, August, 1947, pp. 451–456, figs. 2 references. (*See* AER 2/47:25.)

Subsonic Flow Over Thin Oblique Airfoils at Zero Lift. Robert T. Jones. *U.S., N.A C.A., Technical Note No. 1340,* June, 1947. 20 pp., diagrs. 3 references.

Three-dimensional flows are obtained from a distribution of "pressure sources" in the chord plane of the airfoil. The shapes obtained are symmetrical airfoils at zero lift. The calculations are simplified by considering airfoils composed of conical or cylindrical surfaces In these cases the sources can be arranged in lines of uniform strength following the generators of the surface. Each line source produces a deflection of the streamlines crossing over the surface The pressure field of the line source can be represented by systems of straight rays of equal pressure (isobars) radiating from the ends of the line source. In the case of the sweptback wing the pressure distribution remains qualitatively similar at subsonic and supersonic speeds. The solutions are given explicitly for Mach Number 0 but are extended to other Mach Numbers by the Prandtl transformation.

Theoretical Aerodynamic Coefficients of Two-Dimensional Supersonic Biplanes. W. E. Moeckel. *U.S., N.A.C.A., Technical Note No. 1316,* June, 1947. 31 pp., diagrs. 5 references.

Calculations show that in a frictionless supersonic air stream, biplanes of triangular cross section yield higher lift-drag ratios than diamond airfoils of the same thickness ratio. For high lift coefficients, unsymmetrical biplanes yield higher lift-drag ratios than symmetrical biplanes. When friction drag is considered, biplanes with the lower airfoils thicker than the upper airfoils should have higher lift-drag ratios than symmetrical biplanes. For each biplane investigated an optimum spacing was found at each Mach Number. Although the performance of the biplane for this optimum spacing was found to be improved over that of the diamond airfoil, with a constant biplane spacing this improvement was maintained only over a limited range of Mach Numbers near the optimum. Lift and drag coefficients were also calculated for a configuration having convex sections and for one employing a small shock-reflecting surface in place of the lower airfoil.

INDEX

Acoustics 33
Aerodynamics 33
Air Laws and Regulations 37
Air Mail 39
Air Transport—General 39
Air Transport, Cargo 39
Air Transport, Scheduled 39
Airplane Descriptions 40
Airplane Design 41
Airports 41
Airways and Traffic Control 45
Control Systems 45
Education and Training 45
Electrical Equipment 45
Engine Parts and Accessories . . . 47
Engines—General 47
Engines, Gas Turbine 47
Engines, Reciprocating 49
Engines, Rocket 49
Fire Prevention 49
Flight Technique 49
Flight Testing and Performance . . 49
Fuels 51
Gliding and Soaring 51
Guided Missiles 51
History 53
Ice Prevention 53
Instruments—General 53
Instruments, Engine 53
Instruments, Flight 53
Instruments, Meteorological 55
Insurance, Safety, and Rescue . . . 55
Landing Gear 55
Lubrication and Lubricants 55
Maintenance 55
Materials—General 57
Materials—Metals and Alloys . . 57
Materials—Plastics and Plywood 57
Materials—Protective Coating . . 58
Medicine 58
Meteorology 58
Military Aviation 58
Navigation 59
Photography 59
Production—General 59
Production Methods 59
Production Tools and Equipment 61
Propellers 61
Radio and Electronics 61
Rotating Wing Aircraft 63
Seaplanes and Flying Boats 63
Stress Analysis and Structures . . . 65
Wind Tunnels and Laboratories . 67

The Method of Characteristics in Supersonic Flow. G. Temple. *Gt. Brit., Aeronautical Research Council, Reports and Memoranda No. 2091*, January, 1944. 17 pp., figs. 4 references.

An account of the Ackeret-Prandtl-Busemann method of characteristics for the graphical solution of problems of supersonic flow. The theory has been developed anew from a physical point of view in order to expose those properties of characteristics which are required for practical application to supersonic problems. The necessary numerical tables are included. Partial differential equations are not used except to derive the Bernoulli energy equation for compressible potential flow.

Investigation of Heat Transfer and Friction Loss for Steady Flow at Ultra-High Velocities. N. V. Iluchin. (*U.S.S.R., Akademiia Nauk, Izvestiia*, No. 5, 1946, pp. 703–718.) *The Engineers' Digest*, Vol. 4, No. 5, May, 1947, pp. 213–224, diagrs. 8 references.

The development of formulas for the coefficient of heat exchange and the coefficient of flow resistance which take into account the temperature factor. These formulas are valid for Reynolds Numbers up to 10^6. A test setup used to verify this theory is described in detail. The results of the experiments followed closely those derived from the formulas.

Calculations of the Supersonic Wave Drag of Non-Lifting Wings with Arbitrary Sweepback and Aspect Ratio: Wings Swept Behind the Mach Lines. Sidney M. Harmon and Margaret D. Swanson. *U.S., N.A.C.A., Technical Note No. 1319*, May, 1947. 40 pp., diagrs. 4 references.

The supersonic wave drag for a series of wings having symmetrical biconvex sections, i.e., composed of two parabolic arcs, at zero lift with untapered plan forms and various angles of sweepback and aspect ratios is calculated. The Mach Number is varied from 1.0 to a value corresponding to that at which the Mach line coincides with the wing leading edge. The wing is considered to be cut off in a direction parallel to the direction of flight. Results are presented in a unified form that permits the direct determination from a single chart of the wave drag for this family of wings for an extensive range of sweepback angle and aspect ratio for Mach Numbers from 1.0 to the value corresponding to that at which the Mach line coincides with the wing leading edge or is equal to the secant of the angle of sweepback. Although the calculations were made for the biconvex profile, the data may be applied to indicate corresponding results for profiles approximately similar to the biconvex.

Six-Component Measurements on a Straight and a 35° Swept-Back Trapezoidal Wing With and Without Split Flap. G. Thiel and F. Weissinger. (*ZWB/UM/1278*, August 1, 1944.) *U.S., N.A.C.A., Technical Memorandum No. 1107*, June, 1947. 61 pp., illus. 12 references.

Besides a substantially inferior aileron effect, the sweptback wing is less favorable than the straight wing because of a somewhat greater variation in rolling moment caused by yaw and variation in pitching moment due to the stall-development pattern.

Wind-Tunnel Investigation of the Boundary Layer and Wake and Their Relation to Airfoil Characteristics—NACA 65_1-012 Airfoil with a True Counter Flap and a Beveled-Trailing-Edge Flap. Robert A. Mendelsohn. *U.S., N.A.C.A., Technical Note No. 1304*, June, 1947. 70 pp., illus. 9 references.

Measurements obtained from two-dimensional tests conducted in the $2^1/_2$-by-6-ft. test section of the Langley stability tunnel indicated that the static-pressure gradient through the boundary layer may be large in regions where the airfoil has a small radius of curvature. A static-pressure rise at the vertical position of minimum wake velocity for some sections exists just behind the trailing edge. This pressure rise behind the trailing edge increased with an increase in angle of attack and flap deflection. The theoretical boundary layer parameters were in good agreement with those measured, except near the trailing edge.

Lift Increase by Blowing Out Air, Tests on Airfoil of 12 Percent Thickness, Using Various Types of Flap. W. Schwier. (*Göttingen, ZWB/PB/1658*, September 15, 1942.) *U.S., N.A.C.A., Technical Memorandum No. 1148*, June, 1947. 34 pp., diagrs. 8 references.

Air was expelled in a stream tangent to the wing surface at a point directly in front of the flap and at the opening between the wing and the hinged nose. Lift increased in proportion to the

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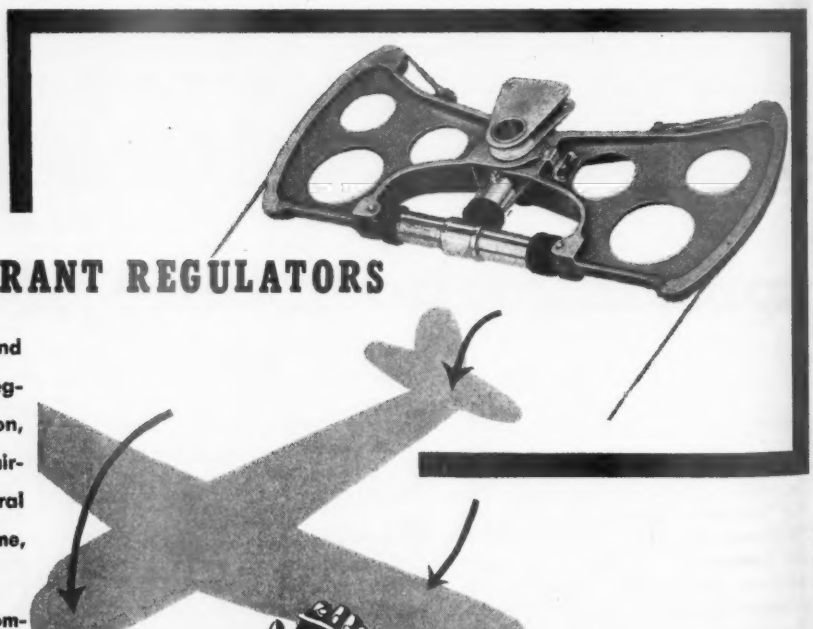

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volume of air expelled. While the highest lift coefficients were measured when the total volume of air was applied at the flap only, the air expelled at the nose maintained unseparated flow at greater angles of attack.

Theoretical Investigation of Drag Reduction in Maintaining the Laminar Boundary Layer by Suction. A. Ulrich. (*Braunschweig, Technische Hochschule, Aerodynamisches Institut, Bericht Nr. 44/8*, March 20, 1944.) *U.S., N.A.C.A., Technical Memorandum No. 1121*, June, 1947. 55 pp., figs. 10 references.

Calculations to determine the laminar boundary-layer stability were carried out for three velocity profiles, each of which had been calculated exactly. Boundary-layer stability was increased greatly by suction but was reduced greatly by blowing, for although the suction quantities are increased slightly, the critical Reynolds Number is greatly increased and approaches the value found by Bussmann-Münz for the asymptotic suction profile. The minimum suction quantities that are required in order to maintain the laminar boundary layer were determined for a plate with continuous suction and for a plate with uniform suction. The drag reduction obtained by maintaining the laminar boundary layer at $Re = 10^7$ was found to be 80 per cent of the turbulent drag without suction.

Tests of the NACA 64$_1$A212 Airfoil Section with a Slat, a Double Slotted Flap, and Boundary-Layer Control by Suction. John H. Quinn, Jr. *U.S., N.A.C.A., Technical Note No. 1293*, May, 1947. 55 pp., illus. 5 references.

Substantial increments in maximum lift appeared obtainable by the use of boundary-layer suction on the N.A.C.A. six-series airfoil. The ultimate value of the maximum lift coefficient, however, appeared to be limited by separation from the airfoil leading edge. Tests were conducted on an airfoil section with a leading-edge slat, a double-slotted flap, and a single boundary-layer suction slot at 0.40 chord to determine the increase in maximum lift coefficient attainable with this combination of high-lift devices. In general the maximum section lift coefficient was increased and the minimum section drag coefficient reduced by applying boundary-layer suction. These changes were accompanied by small increase in the angle of attack for maximum lift and by small decreases in the angle of attack for zero lift.

Theory of Wings in Nonstationary Flow. A. I. Nekrasov. (*U.S.S.R., Akademiia Nauk, Izvestiia.*) *U.S., N.A.C.A., Technical Memorandum No. 1154*, June, 1947. 20 pp., figs.

A comprehensive survey of the investigations that have been made of the aerodynamics of nonstationary flow. In order to examine the phenomenon of flutter which occurs at high flight speeds in certain cases, it has been necessary to depart from the assumption of steady motion in an incompressible fluid. A brief description of the nature of flutter and the early attempts to apply the theory of steady flow serves as an introduction to the work of Birnbaum, who, in 1924, laid the foundation for present studies of the aerodynamic forces acting on a vibrating wing. Subsequent contributions made to this topic in America, Russia, Germany, and Italy are described in detail to show what has been accomplished and what remains to be done.

The Wing Flutter as a Complex Characteristic-Value Problem. I—Comparison on a Twin-Tail Control Surface. Jordon. (*ZWB/FB/Re/1719*, December, 1942.) *U.S., Army Air Forces, Translation No. F-TS-990-RE*, May, 1947. 62 pp., figs. 17 references.

A simplified method of calculating harmonic oscillations, which depends on the fact that there are two different possibilities of motion involved. The iterative calculations are greatly simplified by treating the desired harmonic oscillation as basic torsion oscillation. The convergence range of the method is limited but it can be used in practical applications.

Contributions to Nonstationary Wing Theory. VIII—The Vibrating Wing of Large Aspect Ratio. Dingel and Kuessner. (*ZWB/FB/RE/1774.*) *U.S., Army Air Forces, Translation No. F-TS-935-RE*, May, 1947. 53 pp., fig. 7 references.

Since in certain cases spanwise induced motion is of considerable importance in calculating the flutter in an elevator unit, an integral equation is presented for a wing with large aspect ratio in a stationary down-wash field. This equation can be solved by the procedure used by Mülthopp in solving Prandtl's integral equation for the vortex filament theory. The necessary complex auxiliary functions are developed.

Correlation of Two Experimental Methods of Determining the Rolling Characteristics of Unswept Wings. Robert MacLachlan and William Letko. *U.S., N.A.C.A., Technical Note No. 1309*, May, 1947. 23 pp., illus. 1 reference.

The rolling moments of one tapered wing and two rectangular wings were measured in rolling flow with the wing stationary and in straight flow with forced rotation of the wing. Results showed that for unswept wings the rolling characteristics obtained by rotation of the air agreed with those obtained by forced rotation of the wing. Calculated values agreed closely with experimental results. The variation of damping in roll with angle of attack depends primarily on the variation in the slope of the lift curve with angle of attack. When the wing was yawed the values of the damping in roll and the variation of the aileron hinge moment with roll were approximately proportional to the square of the cosine of the angle of yaw.

Wind-Tunnel Investigation of the Effect of Wing-Tip Fuel Tanks on Characteristics of Unswept Wings in Steady Roll. Harry E. Murry and Evalyn G. Wells. *U.S., N.A.C.A., Technical Note No. 1317*, June, 1947. 18 pp., illus. 4 references.

Tests were made of a rectangular wing and of a tapered wing each with an aspect ratio of approximately 6 to determine the damping in roll. Tests were made of each wing with wing-tip fuel tanks of two sizes and of each wing without tanks. Results indicated that wing-tip fuel tanks of sizes generally used at present increased the damping in roll and the aileron effectiveness of the wings investigated as much as 44 and 16 per cent, respectively. Because the damping in roll tended to increase more than the aileron effectiveness, a decrease in lateral maneuverability of as much as 20 per cent resulted from the installation of the tanks. The effect of the tanks increased with tank size and was generally greater for tanks mounted out on the tips than for tanks mounted down under the tips.

Investigation of the Dynamic Responses of Airplane Wings to Gusts. Harold B. Pierce. *U.S., N.A.C.A., Technical Note No. 1320*, June, 1947. 82 pp., illus. 16 references.

A method of predicting the dynamic response of airplane wings to gusts by considering only the fundamental mode of bending. Tests were made with models to evaluate the method. The results of a series of calculations are given to illustrate changes in the dynamic response of wings which are brought about by changes in gust and airplane parameters. Although the test results are not suitable for predicting dynamic-stress ratios, they indicate that the method is sufficiently accurate to predict the ratio of maximum dynamic wing deflection to maximum fuselage acceleration increment for conventional airplanes. The test results show the need for including aerodynamic damping in calculations of dynamic response of airplane wings.

The irregularity of receipt of publications from abroad necessitates the review of articles in issues several months late. This is done to provide readers with information regarding foreign technical progress as soon as the issues are available in the United States.

The views and opinions expressed in this section are exclusively those of the writers or publications named. They are in no case to be construed as those of the Aeronautical Engineering Review or the Institute of the Aeronautical Sciences.

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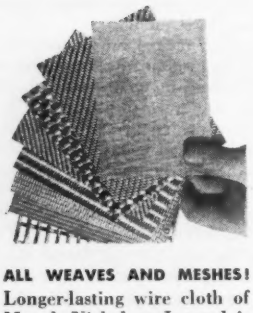

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Wind-Tunnel Investigation of the Air Load Distribution on Two Combinations of Lifting Surface and Fuselage. Carl A. Sandahl and Samuel D. Vollo. *U.S., N.A.C.A., Technical Note No. 1295*, May, 1947. 20 pp., illus. 6 references.

Two combinations of lifting surface and fuselage, representing appreciable variation of lifting-surface span relative to fuselage diameter, were obtained by removing separately the wing and stabilizer of a canard-type model. For the configurations tested, the spanwise loadings on the combinations agreed fairly well with the loadings calculated by Lennertz's method.

Stalling Phenomena and the Tailless Airplane. II, III. A. R. Weyl. *The Aeroplane*, Vol. 72, Nos. 1874, 1879, May 9, June 13, 1947, pp. 478, 479, diagrs.; pp. 624, 627, 628, illus. (Cf. AER 7/47:38.)

II. Simultaneous stalling all along the span is, for a tailless airplane, neither desirable nor practically achievable. This implies that the maximum lift coefficient of the tailless airplane will remain below the optimum value that can be realized for a conventional design with equal aspect ratio and equal airfoil section. It means also that the tailless airplane will not have a wing system of minimum induced drag, although, in practice, the difference may become negligibly small. In all probability, this inherent aerodynamic deficiency would be more than balanced by other advantages of tailless airplanes.

III. The nature of a stall and the mechanics of incipient stall as a factor of the wing plan form indicate that aerodynamically the flying-plank type would seem superior to all tailless systems that rely on effective sweep. An elliptic lift-grading over the span, i.e., minimum induced drag, can be achieved for lift coefficients of practical flight. Structurally, taper would allow the bending moment to be kept low and the torsional load on the wing structure to be reduced possibly to a minimum.

Aerodynamics in Rocket Design. IV—Rocket Streamlining and Controlled Acceleration. R. W. McCarthy. *Pacific Rockets*, Vol. 1, No 4, March, 1947, pp. 11, 12, figs.

Searching Drag Studies Check Speed Impeders. II. *Aviation*, Vol. 46, No 6, June, 1947, pp. 64, 65, figs. (Cf. AER 6/47:38.)

Illustrations of four cowling installations. In one installation, holes cut in the periphery of the cowling just behind cylinder baffles to control airflow and remedy unsatisfactory engine cooling in climb condition were found to cause excessive drag that corresponded to a decrease of 13 m.p.h. in the top speed of the aircraft. The other illustrations show cowling flaps that were sealed with doped tape at the gaps of the hinge lines. Arrows show points of leakage which increased drag when the seals were removed.

The Compressible Flow of Fluids in Ducts. R. R. Jamison and D. L. Mordell. *Gt. Brit., Aeronautical Research Council, Reports and Memoranda No. 2031*, March 22, 1945. 73 pp., diagrs.

A series of 19 graphs shows the relationships among the principal variables met in problems of compressible fluid flow in ducts. The variables have been arranged in dimensionless groups so chosen that the solution of each of the complex equations involved is completely expressed by a family of curves plotted between two of the groups with the flow efficiency as parameter. Since the equations from which these graphs have been derived contain, in general, six variables connected by functions characterized by nonintegral exponents, the solution by customary methods of trial and error is usually a cumbersome process. This drawback is largely eliminated by the use of the flow-function graphs given in this report which are of general application to any duct, irrespective of its dimensions. These graphs deal with choking and supersonic conditions.

Friction Coefficients in Vaneless Diffuser. W. Byron Brown. *U.S., N.A.C.A., Technical Note No. 1311*, May, 1947. 16 pp., diagrs. 6 references.

Friction coefficients calculated from total- and static-pressure surveys in the three constant-area diffusers used in conjunction with a centrifugal impeller indicated comparatively large total pressure losses (three times pipe values) at the diffuser entrance, smaller losses near the exit, and minimum (approximately those for smooth-pipe flow) in the intermediate section of the diffuser. Friction coefficients computed from total pressures were significantly larger than smooth-pipe values only at the diffuser entrance. Losses in the flow in the midsection of the diffuser apparently were about the same as in smooth pipes. Average values of the static-pressure friction coefficient over the entire flow path in the diffuser were about 80 per cent higher than those found from von Kármán's equation for turbulent, smooth-pipe flow. The overall friction coefficient increased with decreasing diameter.

On the Analysis of Internal Flow Machinery. Sabinus H. Christensen. *Journal of Applied Physics*, Vol. 18, No. 6, June, 1947, pp. 587, 588.

In order to obtain a local evaluation of entropy in rapidly moving or rotating passages, the movement or rotation can be speeded up until somewhere within the passage the relative velocity is locally sonic. The exact equations of state, energy, and continuity are then satisfied by a definite entropy value at the blocking point. Since the blocking point is fixed by the passage design, a fourth simultaneous equation is provided which solves the problem of determining the exact thermodynamic state. This technique is believed to be superior to the method in which the state of a fluid is measured by instruments that are forced to transmit their data through commutator rings and packings.

Empirical Method for Frequency Compensation of the Hot-Wire Anemometer. Raymond A. Runyan and Robert J. Jeffries. *U.S., N.A.C.A., Technical Note No. 1331*, June, 1947. 24 pp., diagrs. 6 references.

The disadvantages of the hot-wire anemometer are its nonuniform response characteristics and the fact that the corrections which must be made for compressibility effects are not known. A frequency-compensation circuit is provided, the frequency response of which may be varied continuously to match wind-tunnel operating conditions throughout the design frequency range of the instrument. This circuit permits a rapid empirical determination of the frequency-response characteristics of a hot wire under actual wind-tunnel operating conditions.

Air Laws and Regulations

Warsaw Convention—Comparison of 1929 Text with Proposed Beaumont Revision (Draft of December 1946). *The Journal of Air Law and Commerce*, Vol. 14, No. 1, Winter, 1947, pp. 87–111. The original convention and the proposed draft are presented in parallel text. The definitions of terms found in the Baumont revision are included.

Some Notes on the Warsaw Convention of 1929. Arnold W. Knauth. *The Journal of Air Law and Commerce*, Vol. 14, No. 1, Winter, 1947, pp. 44–56.

A survey of the attitudes of air carriers and other commercial bodies toward the revision of the Warsaw Convention of 1929. The statements that are now required on tickets, checks, and waybills as to the service rendered should be shortened. Liability provisions should be modified. A review of the cases that were litigated under the convention prior to World War II indicates the necessity for clarifying whether return-trip tickets constitute a contract for inter- or intranational transportaion.

Some Anomalies Requiring Amendment in the Warsaw Convention of 1929. K. M. Beaumont. *The Journal of Air Law and Commerce*, Vol. 14, No. 1, Winter, 1947, pp. 30–36.

A substantial revision is necessary of articles three, four, and nine of the Warsaw Convention of 1929. These specify the information that must appear on passenger tickets and luggage tickets, and the effect of these instruments and the air consignment note on the carrier's liability under the transportation contract.

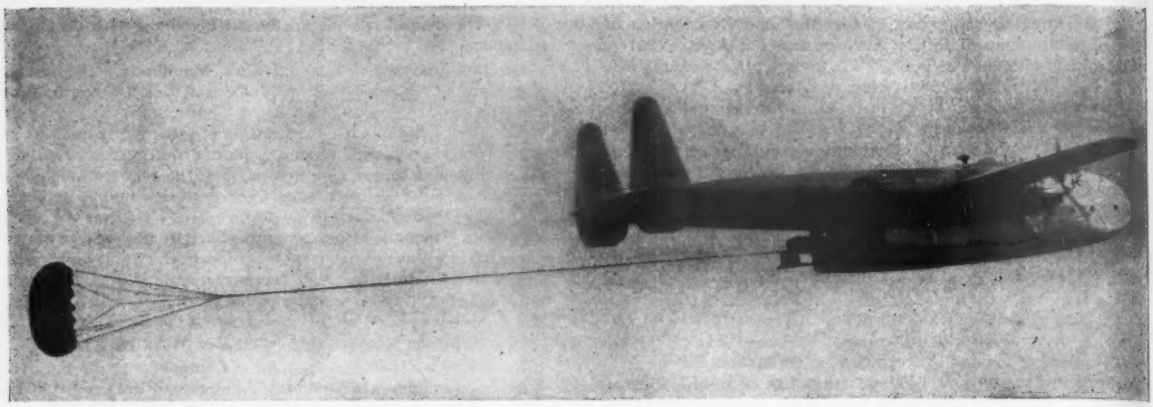
Legal Status of Aircraft Commander—Draft Convention. *The Journal of Air Law and Commerce*, Vol. 14, No. 1, Winter, 1947, pp. 84–86. The convention was adopted at the 15th plenary session of CITEJA held at Cairo, Egypt, on November 16, 1946.

CITEJA Meeting in Cairo, November 6–17, 1946. *The Journal of Air Law and Commerce*, Vol. 14, No. 1, Winter, 1947, pp. 80–82.

A convention was drafted on the legal status of the aircraft commander. A second draft revision of the Warsaw Convention was forwarded to PICAO for consideration. A resolution was adopted containing suggestions to PICAO concerning the manner of setting up the permanent legal committee.

Change of Aircraft on International Air Transport Routes. Oliver J. Lissitzyn. *The Journal of Air Law and Commerce*, Vol. 14, No. 1, Winter, 1947, pp. 57–67.

Existing international agreements that permit change of aircraft make this provision in order to allow either a more economical operation of the service, or to make accommodation for restricted landing facilities, or to permit proper inspection and maintenance. The question whether, in a particular instance, change of aircraft is permissible under an agreement can normally



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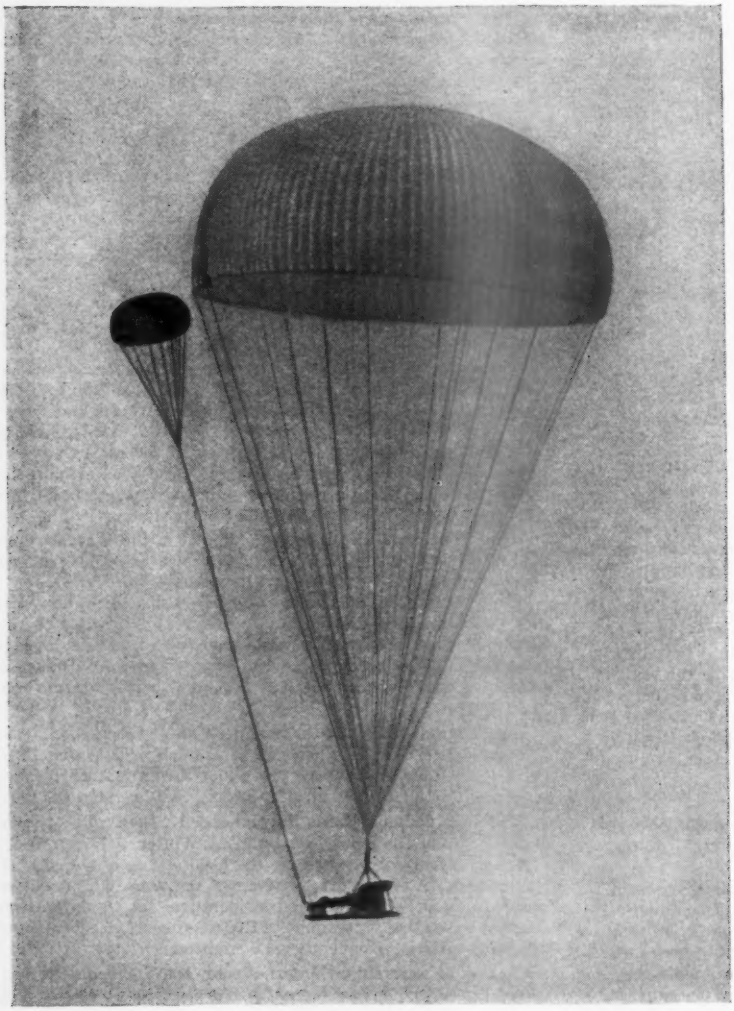

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be answered only after the concrete operating conditions of a given service have been considered.

Activities of the National Association of State Aviation Officials (NASAO) 1941–1947. L. L. Schroeder. *The Journal of Air Law and Commerce*, Vol. 14, No. 1, Winter, 1947, pp. 72–74.

The Regulation Problem. L. Welch Pogue. *American Helicopter*, Vol. 7, No. 7, June, 1947, pp. 14, 40–42.

The characteristics of helicopter operations make some of the existing aircraft regulations inapplicable. A draft of the modifications for part 60 of the Civil Air Regulations for the first time defined helicopters in such a way as to exclude all other types of aircraft and would permit their operation over congested areas at altitudes less than those prescribed for fixed-wing aircraft.

PICAO and the Development of Air Law. Edward Warner. *The Journal of Air Law and Commerce*, Vol. 14, No. 1, Winter, 1947, pp. 1–10.

The Provisional International Civil Aviation Organization found it necessary to set up a legal subcommittee to deal with such matters as the determination of conditions for filing international air transportation agreements with PICAO and their subsequent dispositions, rules and procedures for arbitration proceedings, and the development of international air law. The permanent International Civil Aviation Organization will find it necessary to develop and amplify its legal machinery and will probably find it necessary to function as a judicial body.

The Causby Case and the Relation of Landowners and Aviators—A New Theory for the Protection of the Landowner. Harold D. Nagel. *The Journal of Air Law and Commerce*, Vol. 14, No. 1, Winter, 1947, pp. 112–117. This case involved a conflict between the Government's operation of an airport for Army planes and the use of nearby property as a home and chicken farm.

Wings Across the Border: Procedure for Private Airplanes Flying Across the Canadian Border; Map of Canadian and U.S. Airports of Entry. *Canadian Aviation*, Vol. 20, No. 4, April, 1947, pp. 18–21, illus.

Regulations Concerning Interstate Australian Air Charter Services. *Australia, Department of Civil Aviation, Melbourne, Memorandum, Reference No. 192/101/1093*, August 6, 1946. 4 pp.

This communication lists the documents, information, and legal and customs requirements necessary for grant of an air-line license. Australian government policy on issuance of intrastate licenses has not been defined. It is improbable that a license would be issued to a firm with American principals while there are Australian operators who wish to operate similar services.

Air Mail

More Mail Income Brings Relief to Ailing Airlines. Selig Altschul. *Air Transport*, Vol. 5, No. 6, June, 1947, pp. 53–55, tables.

Starting with Chicago and Southern Air Lines, Inc., and continuing with Capital Airlines and Western Air Lines, Inc., the Civil Aeronautics Board has shown an inclination to grant "temporary" mail-pay relief which maintains the old basic mail rate but introduces a new element known as the "minimum capacity factor." A minimum payment is guaranteed regardless of the mail load, assuring the air line a definite income.

Helicopter Enters Air Mail Field with First Route in Los Angeles. *CAA Journal*, Vol. 8, No. 7, July 15, 1947, p. 77, map.

Air Transport—General

Recent Activities of Provisional International Civil Aviation Organization (PICAO). Richard Kermit Waldo. *The Journal of Air Law and Commerce*, Vol. 14, No. 1, Winter, 1947, pp. 77–79. Survey of activities of the Air Transport and Air Navigation Committees of PICAO from September to November, 1946.

The National Transportation Inquiry. John H. Frederick. *The Journal of Air Law and Commerce*, Vol. 14, No. 1, Winter, 1947, pp. 75, 76.

Soviet Airfreight, Passenger Traffic Up. *Aviation News*, Vol. 7, No. 21, May 26, 1947, p. 30.

Air-line contracts have been concluded for routes between Moscow and Warsaw, Prague, Stockholm, Kabul, and Ulan-Bator. One of the aircraft to be used is the Iliushin-12, a twin-engined transport seating 27 persons. This airplane has tricycle landing gear with two dual wheels.

Foreign Airlines of the World (Including United States Territories). *Air Transportation*, Vol. 10, No. 5, May, 1947, pp. 26–28.

A tabulation giving the name of the air line, the address, country, the officer in charge, and the area of operation. The number of each kind of aircraft in operation and on order is noted for each company. It is indicated whether the service is cargo, passenger, or passenger and cargo, and how many aircraft are used in cargo services only.

Registered Civil Aircraft by States and by Counties Within States. *U.S. Civil Aeronautics Administration*, June 1, 1947. 18 pp.

Air Transport, Cargo

Air Cargo: A New Force in Marketing. John L. Drew and Alan Passen. *The Journal of Air Law and Commerce*, Vol. 14, No. 1, Winter, 1947, pp. 11–23, tables. 10 references.

The transportation of commodities by air offers certain inherent advantages over other forms of transportation. The principle advantage is speed and to a lesser extent convenience. At rates prevailing before the war the inherent advantages and economies made possible by rapid transportation were not sufficient to overcome the rate differential except for a small group of special intermittent users. At present rate levels air cargo is beginning to establish itself as a conventional method of shipment for an expanding though still relatively small group of shippers. At rates expected to prevail over the next few years it seems hardly likely that air cargo will effect broad revolutionary changes in our present system of distribution.

Our Aircargo Capacity. John H. Frederick. *Distribution Age*, Vol. 46, No. 5, May, 1947, pp. 34, 40, illus.

An analysis of the annual fleet-ton-mile capacity at 70 per cent passenger load factor of the aircraft in scheduled service on September 1, 1946, and of those aircraft on order and in the process of conversion on the same date shows that the air lines have only begun to develop the air-cargo field.

Let's Take the Glamour Out of Airfreight. III. Robert F. Odell. *Distribution Age*, Vol. 46, No. 5, May, 1947, pp. 46, 48, 49, 84, illus.

The air transportation industry and the shipper would benefit if it were agreed to base the tariffs on ton-mile costs for the shortest and longest air hauls and if mileage were computed by the great circle mileage between airports and the standard highway mileage for all ground pickups and deliveries.

Air Transport, Scheduled

The Direct Operating Costs of Transport Aircraft. J. J. Green and H. S. Rees. *The Engineering Journal*, Vol. 30, No. 5, May, 1947, pp. 201–210, 219, figs. 18 references.

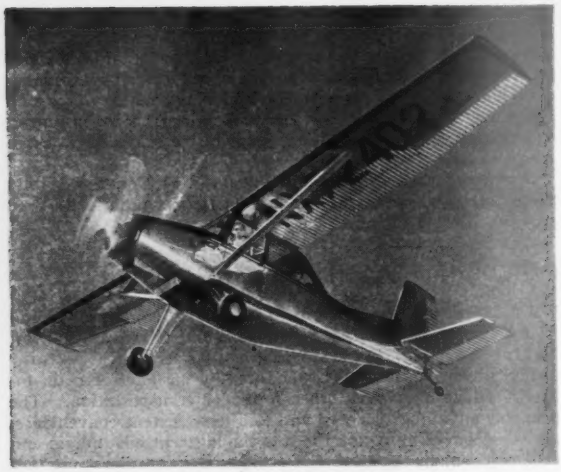
A quick means is offered for calculating reasonably reliable estimates of operating costs where great precision is not a prime requirement. It considers those items of air-line costs which depend directly on the flying operations, as aircraft size, power, initial cost, aerodynamic efficiency, passenger service costs, and overhead costs. Formulas are developed which are based on Canadian costs for domestic operations as given in aircraft manufacturers' brochures. These formulas can be applied elsewhere by making suitable changes. Examples are given of the application of the equations to specific cases. The effect of aircraft size, block, distance, utilization, and cruising speed on the economics of air-transport operations is studied.

How Many Fares Make a Profit? *Aviation*, Vol. 46, No. 6, June, 1947, pp. 84, 86.

Presentation of a cost accounting formula for determining the cost of a passenger-cubic foot per mile. From this calculation it is possible to determine the adequacy of passenger fares and the proportional burden of operating costs being borne by passengers and by cargo.

Paramount Public Interest in Domestic New Route Cases. *The Journal of Air Law and Commerce*, Vol. 14, No. 1, Winter, 1947, pp. 117–122.

An analysis of how the Civil Aeronautics Board weighs the three principal factors—public benefit, financial, and economic—and the competitive factor to determine which is paramount according to the particular facts involved. The flexibility of the Board's formula is demonstrated by pointing out that new facts could, upon presentation, lead to a reversal of a previous decision without any change in standards by the Board.



The Luscombe four-place "Silvaire."

The International Air Transport Association (IATA)—1946 Activities. *The Journal of Air Law and Commerce*, Vol. 14, No. 1, Winter, 1947, pp. 83, 84. A summary of the work of the Committees on traffic and rates and on technical, financial, legal, and general matters.

Air Freight Up 640%. *Australia, Department of Civil Aviation, Release*, September, 1946. 2 pp.

A comparison of the volume of passenger and cargo traffic handled by Australian regular air-line services during the year ending June 30, 1946, with the volume for 1938–1939.

Airplane Descriptions

Attacker. *Flight*, Vol. 51, No. 2003, May 15, 1947, pp. 446, 446a, 446b, 447–450, illus.

A design study of a single-jet fighter (Type 392) produced by Vickers-Supermarine. It is powered by a Rolls-Royce Nene gas turbine of 5,000-lb. thrust and has attained a speed of 580 m.p.h. The laminar-flow wings, which have a span of 36 ft., 11 in., and the tail-wheel undercarriage are basically the same as those of the Spiteful XIV. The stressed-skin aluminum-alloy fuselage has its maximum thickness at 50 per cent. Seven integral fuel tanks and one droppable tank provide for a flight of 3.78 hours.

Twin Contraprops. *Aeronautics*, Vol. 16, No. 4–5, May–June, 1947, pp. 48–51, illus.

The Short Sturgeon is a naval photoreconnaissance airplane or bomber. It is powered by two Rolls-Royce Merlin 140 engines, which give a total of 4,160 hp. Each engine drives two six-bladed wooden counterrotating propellers. The wings fold inward on an oblique hinge pin so that they lie along the ribs of the fuselage with the chord line in a vertical plane. Extended the wing span is 59.9 ft.; folded, it is 20 ft.

The de Havilland Sea Hornet N. F. Mk 21 and the Blackburn B.48. (New Shapes in the Air. IX.) *The Aeroplane Spotter*, Vol. 8, No. 187, May 17, 1947, p. 101, illus.

De Havilland's Sea Hornet N.F. Mk 21 is a development by Heston Aircraft Ltd. of the basic air frame of the de Havilland 103 Hornet. It is a two-place naval night fighter, reconnaissance, or strike trainer, powered by two 1,670-hp. Rolls-Royce Merlin 130 and 131 liquid-cooled twelve-cylinder V-in-line engines. The Blackburn B.48 is a single-place torpedo dive bomber. It is powered by one 2,500-hp. Bristol Centaurus 59 air-cooled 18-cylinder two-row radial engine. The folding wings are hydraulically operated.

Our Supersonic Progress. *The Aeroplane*, Vol. 72, No. 1874, May 9, 1947, pp. 473, 474, illus.

The M 52, a jet-propelled aircraft, designed by Miles Aircraft Ltd. to attain transonic speeds, had conventional layout and was intended to take off and land unassisted. An alternate model was powered by a Walter rocket engine using as fuel alcohol hydrazine hydrate, 95 per cent hydrogen peroxide and compressed air. This design was expected to attain a Mach Number of 1.5 in level flight. Work on the M 52 was suspended pending further research on the best body shape for supersonic speeds. Development models to be launched will contain telemetering equipment.

Martin Proving Six-Jet XB-48. *Aviation*, Vol. 46, No. 6, June 1947, p. 60, illus. (Cf. AER 6/47:32.)

The Martin XB-48 is powered by six G-E turbojet engines. It employs two main retractable landing wheels located one behind the other under the fuselage. Two smaller dolly wheels are located under the outer engine nacelles of the wings to give stability during taxiing.

German and Japanese Rockets. *The Aeroplane*, Vol. 72, No. 1879, June 13, 1947, p. 622, illus.

The DFS 228v-1 developed by the Deutsches Forschungsinstitut für Segelflug, Darmstadt, is a short-range, high-altitude photoreconnaissance monoplane. It is powered by one Walter HWK 109-509 bifuel, liquid-cooled rocket motor. Four explosive bolts jettison the cockpit, which is attached to the main fuselage. When the cockpit drops from the fuselage, a stabilizing parachute opens immediately. At a predetermined altitude the pilot's platform is ejected by compressed air and his parachute is opened. The craft is air-launched pick-a-back from a Dornier Do 217k-2 airplane.

The Fuji Kokuki Oka designated by the Japanese Navy as MXY7 Oka (Cherry Blossom), also known as Baka (Idiot), is a single-seater, expendable, piloted monoplane. It is powered by three type 4, Mk. I Model XX rocket engines. The warhead is fused by the pilot and detonated on impact. The Oka is carried under the bomb bay of a bomber and air-launched. No provision is made for the escape of the pilot.

Russia Today. *The Aeroplane Spotter*, Vol. 8, No. 187, May 17, 1947, p. 101, illus.

A survey of recent developments in the design of Lavochkin, Ilyushin, and Yakovlev aircraft. Soviet jet-propelled aircraft are using developments of the German BMW 003 and the Jumo 004 engines.

Horten Flying Wings. Richard G. Naugle. *Air Trails and Science Frontiers*, Vol. 28, No. 4, July, 1947, pp. 33–38, 112–114, illus. A detailed history of the development of the Horten all-wing aircraft. The control systems used on the various types are described.

Two Spitfires in One. T. S. Wade. *The Aeroplane*, Vol. 72, No. 1877, May 30, 1947, pp. 568, 569, illus.

The Supermarine Spitfire Trainer is a conversion of the Mark VIII Spitfire. The main cockpit has been moved forward to allow room for a rear cockpit. Additional fuel tankage is provided in the wings in place of the inboard cannons. Longitudinal stability has been slightly improved by the substitution of metal-covered for fabric-covered stabilizers.

Italian Transports. *Flight*, Vol. 51, No. 2002, May 8, 1947, p. 415, illus.

Three types of aircraft produced by S.I.A.I.-Marchetti, formerly Savoia-Marchetti, employ wooden wings and steel-tube fuselages. The S.M. 95 is a transport with a normal disposable load of 17,600 lbs. It is powered by four Alfa 131 R.C. 14/15 engines. The S.M. 102 accommodates eight passengers and two pilots. It is powered by two American-built Ranger 52-hp. engines. The S.M. 101 seats two pilots and four passengers and has one Walter Bora 235-hp. engine.

A New Italian Transport. *The Aeroplane*, Vol. 72, No. 1878, June 6, 1947, p. 587, illus. (Cf. AER 4/47:39.)

The Fiat 212 is a three-engined, low-wing, all-metal transport accommodating 24 to 30 passengers. It is powered by three Pratt & Whitney 1,215-hp. R-1830 or three Alfa 128 R.C. 18 engines.

Closing a Gap. *The Aeroplane*, Vol. 72, No. 1877, May 30, 1947, pp. 563–567, illus. (Cf. AER 8/47:37.)

The Cunliffe-Owen Concordia has a wing span of 56.64 ft. It is powered by two Alvis Leonides engines. Range at 190 m.p.h. with a pay load of 1,930 lbs. is 920 miles. Design features of landing gear retraction mechanism and air-frame assembly are detailed. There is a cutaway drawing showing location of components and general construction.

Haltons for Charter Work: Growth of Lancashire Aircraft Corporation. *Modern Transport*, Vol. 57, No. 1470, May 31, 1947, p. 15, illus. (Cf. AER 7/46:97.)

The Handley Page Halton Freighter is an adaptation of the passenger version that was based on the Halifax bomber. It is powered by four 1,650-hp. Bristol Hercules engines. Maximum range is 2,420 miles, with a load of slightly less than 5 tons. In normal practice the fuel load may be reduced to allow a cargo of approximately 6 1/2 tons. The gross cargo volume is 900 cu.ft.

Miles Marathon. *Shell Aviation News* (London), No. 107, May, 1947, pp. 22, 23, illus. (Cf. AER 7/47:39.)

The Marathon passenger transport is powered by four Gipsy Queen 71 engines and has a maximum speed of 230 m.p.h. at an altitude of 6,300 ft. Range is 1,000 miles. The cabin can be modified to accommodate cargo.

The Percival Merganser: Completion of Prototype. *Modern Transport*, Vol. 57, No. 1470, May 31, 1947, p. 15, illus. (Cf. AER 8/47:37.)

The Percival Au 1 Merganser. *The Aeroplane Spotter*, Vol. 7, No. 188, May 31, 1947, p. 117, illus. (Cf. AER 8/47:37.)

The Percival Merganser. *The Aeroplane*, Vol. 72, No. 1876, May 23, 1947, pp. 537–539, illus. (Cf. AER 8/47:37.)

Mooney Single-Seater. *Aviation News*, Vol. 7, No. 23, June 9, 1947, p. 20, illus.

Mooney Aircraft Co. is now flight-testing a single-seater monoplane similar to the Culver radio-controlled PQ-14. It is powered by a 25-hp. revamped Crosley liquid-cooled automobile engine. It develops a speed of 100 m.p.h. and has a range of 400 miles. It incorporates the Mooney patented Simplify control used on the Culver Model V.

New Mounts for Private Owners: The Prestwick Pioneer. *The Aeroplane*, Vol. 72, No. 1876, May 23, 1947, pp. 530, 531, illus.

The Prestwick Pioneer being designed by Scottish Aviation is an all-metal, high-wing, braced monoplane with fixed undercarriage. It is powered by a 250-hp. de Havilland Gipsy Queen 34 engine and seats three passengers and a pilot. It is designed to operate into and out of restricted spaces and is provided with hydraulically operated trailing-edge flaps and leading-edge slats. The former consists of a Fowler-type flap with which is incorporated a split flap. An electrically controlled variable-incidence tail plane is used to permit easy trimming at the low end of the speed range.

Bird or Beast? *The Aeroplane*, Vol. 72, No. 1875, May 16, 1947, pp. 510, 511, illus.

The Aerocar and the Plane-Mobile are considered as typical American roadable aircraft. The Willis Brown Aerocar, built and flown by Southern Aircraft, consists of a three-wheel, two-place road vehicle which comprises the fuselage and power plant. The air frame, wings, tail booms, and control surfaces and the propeller are attached at the airport. The engine is a 125-hp. Franklin flat-four which drives both the pusher propeller and the wheels. The Plane-Mobile, designed and built by Whitaker and Zuck, follows conventional lines. The wing is not entirely removable as in the Aerocar, but each half swings back onto the top of the fuselage.

Airplane Design

Development of the XS-1 Supersonic Research Airplane. R. M. Stanley and R. J. Sandstrom. *Aeronautical Engineering Review*, Vol. 6, No. 8, August, 1947, pp. 22–26, 72, illus.

The XS-1 was designed by Bell Aircraft Corp. for the U.S. Army Air Forces in order to establish the practicability of an airplane of conventional design, construction, and tolerances for transonic and supersonic speeds. To make allowance for buffeting in the transonic region the craft was designed for an ultimate loading of 18 *g*. The rocket power plant that was selected could be controlled to give 25, 50, 75, and 100 per cent of the total 6,000-lb. thrust. The XS-1 was designed to be launched from the bomb bay of a standard B-29, and after extensive glide-testing with and without engine it was flown on December 9, 1946, at 27,000 ft. in powered flight. It reached a Mach Number of 0.795 at 35,000 ft., using 50 per cent of thrust. This power flight and eleven subsequent flights were considered satisfactory.

Analysis for Optimum Transport Airplane Configuration. Philip A. Colman. *Lockheed Aircraft Corp.* (For abstract see "I.A.S. Briefs" on page 29 of this issue, September, 1947.)

Parameters Affecting Aircraft Weight. W. F. Ballhaus. *California Institute of Technology.* (For abstract see "I.A.S. Briefs" on page 31 of this issue, September, 1947.)

The Development of All-Wing Aircraft. John K. Northrop. *Northrop Aircraft, Inc.* (For abstract see "I.A.S. Briefs" on page 31 of this issue, September, 1947.)

The Development of All-Wing Aircraft. (The 35th Wilbur Wright Memorial Lecture.) John K. Northrop. *The Aeroplane*, Vol. 72, No. 1878, June 6, 1947, pp. 596–600, illus. (Extended abstract of a paper.) (Cf. preceding reference.)

The Development of de Havilland Naval Aircraft. F. H. Burrell. *De Havilland Gazette*, No. 38, April, 1947, pp. 2–5, illus.

Mr. Farren on Naval Design Problems. *The Aeroplane*, Vol. 72, No. 1875, May 16, 1947, pp. 507, 508, illus. (Extended abstract of a paper: Design of Naval Aircraft, W. S. Farren.)

The requirements of naval aircraft have imposed certain limitations on design which in the past have justified the view that naval aircraft are inferior to land-based aircraft. Recent trends indicate that this disparity may be overcome by the elimination of the undercarriage, by jet-assisted take-off, and by use of the turbojet.

Naval Aircraft. *Flight*, Vol. 51, No. 2003, May 15, 1947, pp. 438–440, illus. (Extended abstracts of two papers: A Survey of the Technical Problems of the Design of Naval Aircraft, W. S. Farren (cf. preceding abstract); Naval Aircraft and Carrier Equipment, L. Boddington.) Boddington describes the towing or tail-down method of deck launching and compares the characteristics and design of American and British types of arresting gear.

Developments in Carrier Equipment. *The Aeroplane*, Vol. 72, No. 1876, pp. 540–542, illus. (Extended abstract of a paper: Naval Aircraft and Carrier Equipment, L. Boddington.) (Cf. preceding abstract.)

Variable-Span Wings. Edmund W. Coates. *Aeronautics*, Vol. 16, No. 4–5, May–June, 1947, pp. 39–41, diagrs.

A discussion of the advantages of variable wing span for high-speed aircraft. Models have been flown which could accomplish a 16 per cent increase in the wing surface. Fowler-type flaps produce somewhat the same effect. They are mounted on carriages that travel chordwise along the wing. The layout is given of a hypothetical variable-span aircraft designed for supersonic speeds. The wing-loading characteristics are compared with those of the Bell XS-1.

Correspondence on "Design for Maintenance." T. E. G. Bowden. *Royal Aeronautical Society, Journal*, Vol. 51, No. 437, May, 1947, pp. 471–480. (Cf. AER 7/47:41.)

Notes on Semi-Tailless Pushers. Richard G. Naugle. *Western Flying*, Vol. 27, No. 6, June, 1947, pp. 14, 15, 24, 26, illus.

Pusher-type design with the propeller mounted aft of the tail surfaces at the end of a conventional-length fuselage gives to the personal plane the advantages of improved visibility, greater convenience of entrance, lower noise level, and the stability inherent in the pusher-type aircraft.

Pressurized Cabin for Fighters. Messerschmitt. (*Me/262/189*, November, 1943.) *U.S., Army Air Forces, Translation No. F-TS-2635-RE*, May, 1947. 15 pp., diagrs.

Minutes of design conferences between July, 1943, and July, 1944, on the development of pressurized cabins for the Me 262, Me 163, and the Me 109 (Bf 109). Includes extracts from the regulations governing the measurement of carbon-monoxide content of the air in the airplane cabin, an analysis of the advantages and disadvantages of excess cabin pressure, and specifications for cabin air conditioning.

Pilots Are Not Supermen. James L. H. Peck. *Air Trails and Science Frontiers*, Vol. 28, No. 4, July, 1947, pp. 22, 23, illus.

Standardized functional cockpits will make the job of the pilot easier and lessen the training and operational accidents that have been caused by aircraft designs that ignored the psychological and physiological limitations of the pilot.

Airports

All-Weather Approach Lighting. W. A. Pennon. *Airports*, Vol. 11, No. 6, June, 1947, pp. 12, 13, 48, illus. (Cf. AER 6/47:36.)

High candle-power, fog-penetrating lights that are visible at 1,000 ft. in all weather can be installed as a supplement to existing approach systems. The lights give the pilot visual indication of the approach, designate the correct runway, and illuminate the runway itself.

Airfields in Great Britain: A Review of the Past, the Present Position, Suggestions for the Future. H. R. Gillman. *Flight*, Vol. 51, No. 1999, April 17, 1947, p. 349.

London's Weather-Wise Airport. Courteney Edwards. *Airports*, Vol. 11, No. 6, June, 1947, pp. 32, 33, illus.

Heathrow Airport maintains a 24-hour weather forecasting service. Each departure is supplied with a synoptic chart that shows the latest weather information along the route and at the destination. Final construction plans for the airport call for nine runways in a pattern of three triangles. Each runway will be

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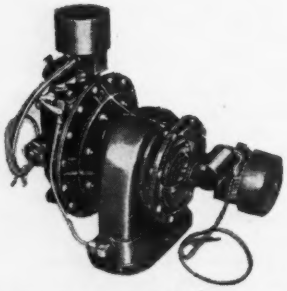
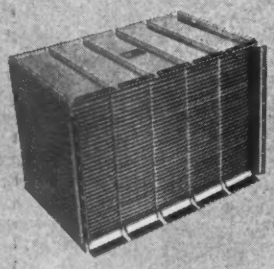
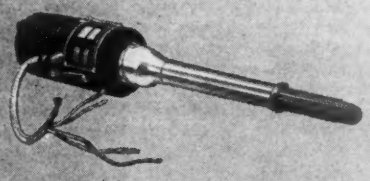


Cabin Pressure Regulators: Perfected for use on the B-29, AiResearch regulators are easy to maintain and revolutionary in performance. They operate on the pressure differential between cabin and outside air, with no other source of power. Cabin altitude and rate of change can be pre-selected.



Intercoolers: AiResearch all-aluminum intercoolers increased the high altitude performance of the P-38, the P-61, the B-17, the B-29 and other planes. Today's *improved* intercoolers continue to excel on all counts — light weight, high cooling efficiency, great structural strength and resistance to corrosion.



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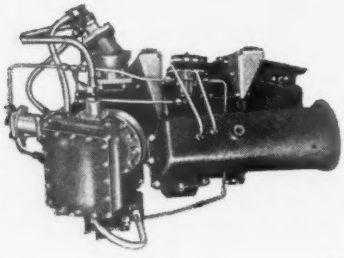
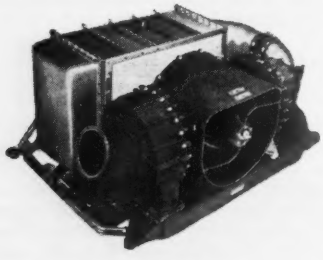


Cabin Superchargers: This high speed compressor for the new Constellation creates 50 pounds airflow per minute at an output pressure of 15 p.s.i. Variable speed drive keeps output constant despite changes in engine speed. A primary compressor is being produced for the Convair 240.



Refrigeration Units: Used for cooling hot, compressed air from the cabin superchargers, this new Constellation unit incorporates an air expansion turbine, secondary compressor and heat exchanger. Types being produced for various planes have capacities from 7 to 100 pounds airflow per minute.

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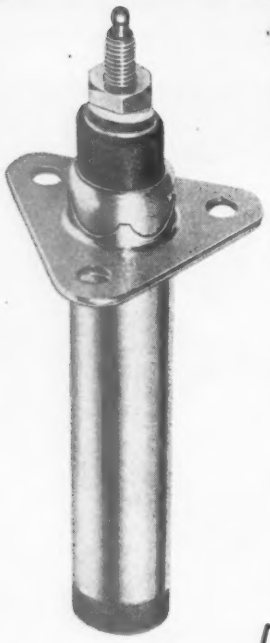

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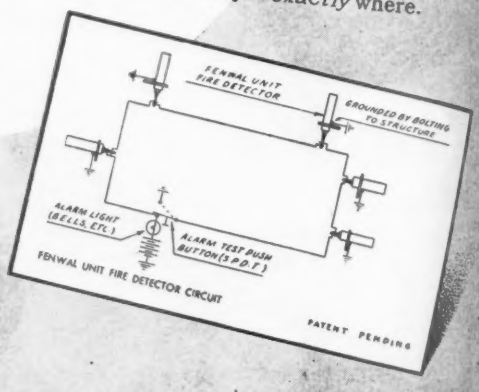
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London Airport Control. *The Aeroplane*, Vol. 72, No. 1876, May 23, 1947, pp. 544–546, illus.

The London Airport: Expansion in Distinct Stages. *Modern Transport*, Vol. 57, No. 1463, April 12, 1947, p. 7, maps.

Fog Dispersal. A. C. Hartley. *Royal Society of Arts, Journal*, Vol. 160, No. 4732, December 6, 1946, pp. 22–38, illus. Discussion, pp. 38–44. A detailed account of the development of FIDO (Fog Investigation Dispersal Operation).

Flexible Pavement-Requirements for Airports. Report Delivered at the Second Annual Michigan Aeronautics Conference, Lansing, May 9, 1947. W. R. Macatee. *American Road Builders' Assn., Washington, Technical Bulletin No. 118*, 1947. 7 pp., figs.

Airport Drainage: Important Factor for Continuous Operation. *Airports & Air Transportation* (London), Vol. 1 (N.S.), No. 48, May, 1947, pp. 516–518, illus.

Problems of Fuel Dispensing. Robert C. Read. *Airports*, Vol. 11, No. 6, June, 1947, pp. 20, 21, illus.

Airways and Traffic Control

Instrument Approach System. D. West. *Aeronautics*, Vol. 16, No. 4–5, May–June, 1947, pp. 44–46, diagrs.

A description of the instrument approach system proposed by the Provisional International Civil Aviation Organization. Detailed illustrations are given of the instrument readings as observed by the pilot as he approaches the airport, locates his course, begins his approach, and passes the distance marker beacons. A block diagram shows the arrangement of the air-borne equipment.

Navigational Aids: The Decca Navigator System. II—The English Chain of Stations. *Airports and Air Transportation* (London), Vol. 1 (N.S.), No. 48, May, 1947, pp. 501–505, illus. (Cf. AER 7/47:41.)

The English Chain of Decca navigator stations is a "star" pattern chain consisting of a master station, slightly north of London, and three slaves located in the south of England. The operational area of this chain, which works on a 24-hour basis, is at present claimed to extend to a range of 300 miles from the center of the chain.

The Story of GCA. II. Chester F. Porterfield. *Air Trails and Science Frontiers*, Vol. 28, No. 4, July, 1947, pp. 34, 35, 78–80, illus.

Control Systems

Effect of Horizontal-Tail Position on the Hinge Moments of an Unbalanced Rudder in Attitudes Simulating Spin Conditions. Ralph W. Stone, Jr., and Sanger M. Burk, Jr. *U.S., N.A.C.A., Technical Note No. 1377*, June, 1947. 63 pp., illus. 3 references.

An investigation to determine the effect of horizontal tail position on the rudder hinge-moment coefficients and pedal-force characteristics of an unbalanced rudder with rectangular plan form in attitudes simulating spin conditions indicates that the low rearward position of the horizontal tail gave the smallest rudder hinge-moment coefficients and pedal forces. The shielding effect of this position must have been large relative to the other horizontal tail positions. High forward position gave the largest hinge-moment coefficients and pedal forces, indicating that the relative shielding effects of this position were small.

A Designer on How Two-Control Systems Fail. A. R. Weyl. *The Aeroplane*, Vol. 72, No. 1879, June 13, 1947, p. 618, illus.

The restriction of elevator controls, which is an antistall spinproof feature of the Ercoupe, does not contribute to safety but constitutes a dangerous hazard. Elevator control restriction can only prevent the pilot from deliberately assuming an angle of attack that would result in a stall. It cannot prevent stall and consequent spin or dive brought about by adverse wind conditions. The reduced elevator force will make recovery sluggish; a greater altitude will be required to come out of an accidental stall.

New Simplicity in Servos Improves Automatic Control. Jack Andresen. *Aviation*, Vol. 46, No. 6, June, 1947, pp. 70, 71, illus.

For systems where the output of the sensing element translates to a weak mechanical motion, an electrical contact is put on the mechanical indicating part. A mating contact is located on a motor-driven part designed to follow the indicator. When the contacts touch, the motor rotates in a direction to separate them; when they are separated, the motor rotates to close them. Thus the follower is continuously hunting back and forth with the contacts touching and separating. A reversing circuit is used which produces a phase shift of from 60° leading to 60° lagging. This causes the instantaneous reversal of the low-inertia two-phase induction motor that operates with about 83 per cent of the full torque obtainable on a regular two-phase supply.

Sperry Hydraulic Remote Control. *Sperry Products, Inc., Release*, June 3, 1947. 1 p., illus.

The new type HC03 Sperry Hydraulic Remote Control is considerably more powerful than previous models. In spite of its 50 lbs.in. torque capacity on the pressure stroke, it is slightly lighter than the type HC01 that it replaces. The control consists of two units, which, when joined by a single line of tubing and filled with oil, form a self-contained, completely enclosed hydraulic system that provides remote control at a distance up to 35 ft. General uses cover throttle, mixture, governor, valve, and position-indicator control.

Stabilizing Servomechanisms for Optimum Overall Performance. S. W. Herwald. *Product Engineering*, Vol. 18, No. 6, June, 1947, pp. 132–137, illus., figs. 15 references.

A promising approach to the stability and performance of a servomechanism system in the preliminary design stages is the analogue or analogy computer. With this type of equipment, once the error detector, amplifier, error corrector, and the means of attaining stability have been selected, the circuit equivalent of the actual servomechanism is reproduced by electrical elements. Optimum values of design parameters and actual transient response to any arbitrary function are then obtained quickly and accurately.

Education and Training

Naval Aviation and Instructional Technique. A. C. G. Hutchings. *Aircraft Engineering*, Vol. 19, No. 219, May, 1947, pp. 159–161, diagrs.

A short course in instructional technique conducted by the Royal Navy gives a training in pedagogy to the instructors who teach the naval air force ground crew. The syllabus emphasizes the responsibility of the instructor for awakening and stimulating the interest and enthusiasm of the student. The guided discussion is recommended as a classroom technique in order to appeal to the intellect and reasoning powers of the student rather than to rote memory.

Gadget Heaven. *Flying*, Vol. 41, No. 1, July, 1947, p. 35, illus.

The U.S. Navy Special Devices Center at Sands Point, Long Island, developed more than 500 different types of training equipment for the Navy, Army, and other organizations, between 1941 and 1945. One mechanism that was developed, a contact flight trainer, employs an optical device, known as the "peritelengiscope," which makes it possible for the pilot to see an overhead relief map as though it were under his aircraft. Its periscope extension rotates and has a vertical motion simulating changes in altitude, direction, and inclination of the aircraft.

Electrical Equipment

Characteristics of Bosch Retraction Motor (German). D. L. Holton. *U.S., Army Air Forces, Technical Report No. F-TR-2154-ND*, April, 1947. 8 pp., illus.

A description of a reversible electric motor used on German aircraft and as a starting motor for the Riedel gasoline engine. The circuit diagrams, torque speed curve, and efficiency cure arve given. The motor weighs 1¼ lb. and, at 5,000 r.p.m., requires an input of 24 volts at 10.4 amp.

Ample Amperage. Louis R. Huber. *Boeing Magazine*, Vol. 17, No. 6, June, 1947, pp. 10, 11, 14, illus.

The Boeing Stratocruiser employs electricity for over 100 operations. Electrical equipment weighing 2,523 lbs. generates and distributes 70 kw. and includes six a.c. generators, two alternators, 119 electric motors, and three rotary converters. In addition to the landing gear, the wing flaps, refrigerator compressors, propeller-pitch motor, oil transfer pump, and windshield deicers are operated by electricity.

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Engine Parts and Accessories

The Heat Transfer Performance of Louver Surfaces and Their Application to Aircraft Intercoolers. P. S. Barna. *Australia, Council for Aeronautics, Report No. ACA-22,* March, 1946. 19 pp., illus. 15 references.

The basic concept of using a heat transfer surface broken up into such short lengths that a fresh laminar boundary layer forms on each has proved to be sound. The formation of such a boundary layer is accomplished by using a louvered sheet, formed by making a series of parallel cuts in a sheet of metal and twisting each of the strips lying between adjacent cuts through the same angle. The plane of the convolution is then presented to the air stream at the same angle as that through which the strips were turned. High theoretical values of heat-transfer coefficient are obtained which can be computed on the basis of a single flat plate. This gives a marked decrease in the area of cooling surface for a given heat dissipation. From laboratory data it appears that the louvered core should be 33 per cent lighter than the most efficient type generally in use which employs the split V fin.

Effect on the Performance of the Turbosupercharged Engine of an Exhaust-Gas-to-Air Heat Exchanger for Thermal Ice Prevention. Bonne C. Look. *U.S., N.A.C.A., Memorandum Report No. A5 H23 (Wartime Report No. A-30),* August, 1945. 43 pp., illus. 6 references.

Products of Eaton. 1947 Edition. *Eaton Mfg. Co., Advertising Dept.,* 739 East 140th Street, Cleveland 10, Ohio. 40 pp., illus.

A booklet describing the company's principal products. Single-speed and two-speed axles, valves, valve gear assembly mechanisms and accessories, coil and leaf springs, spring lock washers, snap rings, cold drawn steel, grey cast iron, vehicle heaters, and stampings are supplied to the aircraft, marine, oil, machine tool, construction, and communications industries. The Dynamatic Corp., a new subsidiary of Eaton, manufactures dynamometers, electronic governors, and dynamatic brakes.

Supercharger Clutch Linings. *Aircraft Production,* Vol. 9, No. 104, June 1947, pp. 213–217, illus.

The drive of the Napier Saber two-speed supercharger is transmitted by a double-cone friction clutch. The design of the transmission made it necessary that a complete seizure be accomplished in 0.5 to 1.0 sec. Since the cone surfaces worked in a bath of oil under pressures up to 1,200 lbs. per sq.in., oil absorption had to be controlled accurately in order to maintain the correct friction coefficient. British Belting and Asbestos Ltd. developed a liner that met these requirements. Bias-woven asbestos tape was impregnated with phenolic resin, wound in a helix on a mandril, and formed into cylinders. The cylinders were then cut to the proper size and machined to shape.

Engines—General

Trends in Aircraft Power Plants. Milton Clauser. *Douglas Aircraft Co., Inc.* (For abstract see "I.A.S. Briefs" on page 31 of this issue, September, 1947.)

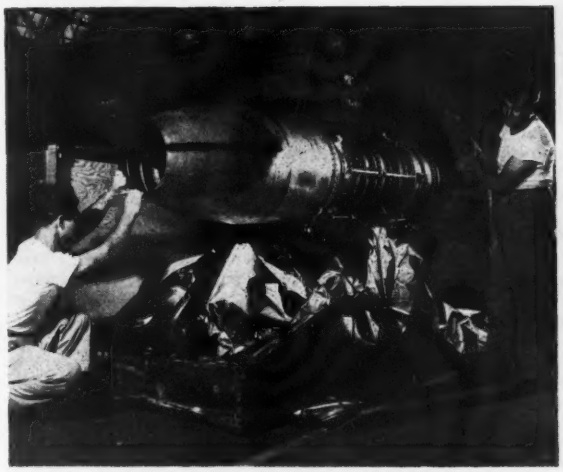
Experiments on Stability of Bunsen-Burner Flames for Turbulent Flow. Lowell M. Bollinger and David T. Williams. *U.S., N.A.C.A., Technical Note No. 1234,* June, 1947. 16 pp., illus. 4 references.

Preliminary study of the stability of Bunsen-type flames seated on the burner lip and suspended above the burner. The variables chosen were the fuel-air ratio by volume and the mixture flow rates at which the flame would blow out or leave the lip of the burner. For fuel-air ratios of less than 15 per cent, in turbulent as well as laminar flow, the velocity gradient at the burner wall is a satisfactory variable for correlating the fuel-air ratio required for blow-off of seated flames. In this fuel-air ratio range, for turbulent flames, wall velocity serves as a correlating variable. Regions of stability are outlined in plots of fuel-air ratio as a function of Reynolds Number for flames seated and for flames suspended well above the burner lip.

Thrust and Horsepower. *Shell Aviation News* (London), No. 107, May, 1947, p. 21.

An explanation of the difference between the methods of rating an engine by thrust and by horsepower, and how they can be related to each other. The formulas derived are applied to jet engines.

Experiments with Gasoline Vapors in Testing a Reaction Device. Klanke and Brinkmann. *(ZWB/FB/1421,* July, 1941.)



The new Westinghouse 24-C axial-flow jet engine, now being installed in the McDonnell "Banshee," Chance Vought "Pirate," and seven other still classified Army and Navy fighter airplanes.

U.S., Army Air Forces, Translation No. F-TS-989-RE, May, 1947. 12 pp., illus.

An account of incomplete experiments with a reaction device in which the fuel was vaporized prior to injection into the combustion chamber. Utilization of the waste heat of the exhaust produced a high vapor pressure and increased the efficiency of the engine.

Engines, Gas Turbine

A Survey of the Calculated Efficiencies of Jet Power Plants. Joseph H. Keenan and Joseph Kaye. *Journal of the Aeronautical Sciences,* Vol. 14, No. 8, August, 1947, pp. 437–450, figs. 2 referenees. (*See* AER 2/47:26.)

The Controllability of Turbojets in Reference to Flight Performance and Altitude (Project No. DP-170). Heinz E. Schmitt. *U.S., Army Air Forces, Technical Report No. F-TR-2142-ND (GS-AAF-Wright Field No. 11),* March, 1947. 9 pp., figs.

Two disadvantages of the turbojet engine are slow acceleration and the difficulty of maintaining a low idling-speed thrust. The acceleration time can be reduced by employing a variable-area thrust nozzle that will open during acceleration and by taking advantage of tail-pipe combustion during take-off and climb. The nozzle would be controlled automatically by the r.p.m.'s of the propeller. Auxiliary chambers that burn acetylene, installed between the main combustion chambers, would improve combustion at high altitudes and would enable the engine to be restarted under conditions that do not provide the proper fuel-air mixture ratio. These intermediate chambers, if fitted with an electric ignition system, could be cut in manually or could be controlled automatically by the barometric pressure and an r.p.m. counter.

Fundamentals of the Control of Gas-Turbine Power Plants for Aircraft. III—Control of Jet Engines. H. Kühl. *(Deutsche Versuchsanstalt für Luftfahrt, Forschungsbericht Nr. 1796/3,* July 22, 1943.) *U.S., N.A.C.A., Technical Memorandum No. 1166,* May, 1947. 28 pp., diagrs. 2 references. (Cf. AER 7/47:44.)

From the characteristic values of the specific fuel consumption, thrust coefficients, and corresponding flow areas of the jet nozzle at various Mach Number, at various pressure ratios in the compressor, and at various ratios of combustion temperature to atmospheric temperature, representations were obtained which were independent of atmospheric pressure and temperature. From these it is shown that, for the realization of the maximum possible output and the attainment of the highest possible fuel utilization, the jet-nozzle flow area should be governed by the pressure ratio in the compressor.

In addition to mechanism for the control of the jet-nozzle flow area, there must be means of controlling the quantity of fuel. A schematic diagram of a control system is given in which the

manual control selects the quantity of fuel to be supplied to the combustion chamber and the jet-nozzle flow area is determined by a governor geared to the turbine and a thermocouple reacting to the temperature ahead of the turbine. A modification provides for a further adjustment of the fuel supply to compensate for the pressure ratio.

A second diagram is given for a control system in which the pilot selects the speed desired rather than the fuel supply. The limitations of a constant jet-nozzle flow area are discussed and a control system for this type of system is suggested.

Power "Dividends" Seen Available for Turboprops. S. A. Tucker. *Aviation*, Vol. 46, No. 6, June, 1947, pp. 44, 45, figs.

The Brown Boveri Co., Switzerland, is testing a gas power process that increases the thermal efficiency of a conventional gas turbine from 18 to 22 per cent. A "piston" of hot gas expands in the same "cell" that is used for compression. The unit consists of a number of cells open at both ends arranged around a shaft driven by a constant-speed device. This rotor turns between fixed plates that serve as valves. Both air and gas enter from the same side and leave on the opposite side. Air entering a cell sets up a pressure wave that is considerably greater than its velocity head. The gas inlet is timed so that a second compression wave forces the air out at pressures approaching three times that of the air inlet. The charge of gas trapped at the low point of a pressure wave is exhausted at the proper time to leave the cell at a lower pressure than the air inlet. The unit, known as "Comprex," is employed as a second-stage compressor.

Gas Turbine Combustion Problems. E. A. Watson and J. S. Clarke. *The Aeroplane*, Vol. 72, No. 1878, June 6, 1947, pp. 588, 589, illus. (Extended abstracts of two papers.)

Discussions of research conducted during the last 5 years on fuel atomization, flame tube cooling, and the effect of high altitudes on engine instability, flame extinction, and engine roughness.

Thermodynamic Factors in Turbine-Aircraft Design. Joel Whitney. *Aviation*, Vol. 46, No. 6, June, 1947, pp. 46–48, illus. An outline of the steps to be taken by the designer in selecting the cooling and ducting system of a propeller-driven gas turbine.

Effects of Temperature Distribution and Elastic Properties of Materials on Gas-Turbine-Disk Stresses. Arthur G. Holms and Richard D. Faldetta. *U.S., N.A.C.A., Technical Note No. 1334*, June, 1947. 22 pp., figs. 3 references.

Arbitrarily selected cooling conditions were assumed to exist in a typical disc, and the corresponding thermal and centrifugal stresses were calculated. The safety margin was determined by adding algebraically the centrifugal and thermal stresses present at any point and comparing the resultant stress state with the rupture strength of the material at the temperature of the point. Attempts to increase the strength of the material by cooling the center of the disc might set up thermal stresses that would reduce the safety margin. The stresses set up by small thermal gradients subtracted from the centrifugal stresses in the region of the rim. Centrifugal stresses were slightly effected by changes in the relation between modulus of elasticity and temperature.

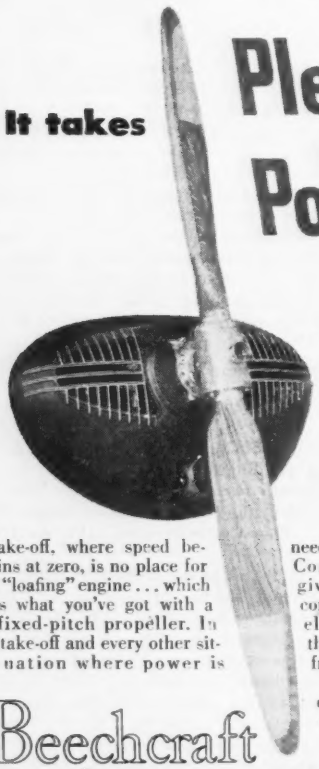
Stressing of Gas Turbine Blading. J. Hodge. *The Engineers' Digest*, Vol. 4, No. 5, May, 1947, pp. 203–205, figs. (Cf. AER 3/47:59.)

Stresses in Turbine Disks at High Temperatures. E. P. Popov. *The Franklin Institute, Journal*, Vol. 243, No. 5, May, 1947, pp. 365–389. diagrs.

This paper is confined chiefly to a study of stress distribution and creep deformation in rotating discs during the steady state—i.e., during that service period beyond the interval in which rather rapid transient creep takes place. A modified theory is presented which requires only data from tension creep tests for its solution. A comparison of the modified method and Bailey's method shows that the results obtained by the two methods are in good agreement and that the solution has the advantage of simplicity in that it requires only two experimental constants.

Development of the Goblin Engine. E. S. Moult. *Flight*, Vol. 51, No. 2003, May 15, 1947, pp. 442, 443, illus. Discussion, p. 450. (Extended abstract of a paper.)

An outline of the development phases, test runs, and modifications made in the design of the engine. Between 1941 and 1945 no major change was made in the compressor. The number of



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blades in the turbine was increased. Other improvements made in the turbine were principally metallurgical.

A Gas Turbine of Great Power and Versatility, The de Havilland Ghost. *De Havilland Gazette*, No. 38, April, 1947, pp. 6, 7, illus.

Engines, Reciprocating

German BMW 801 Engines. (Project No. DP-34.) Robert G. Allen. *U.S., Army Air Forces, Summary Report No. F-S U-1141-ND*, May, 1947. 26 pp., illus. 10 references.

A compilation of available data on the five basic types of the BMW 801 engine. This is an air-cooled, 14-cylinder, four-stroke, two-row radial, fuel-injection aircraft engine, with reduction gear and engine-driven cooling fan, which was designed and manufactured by the Bayerische Motoren Werke. In addition to the design development and description of the main components and systems of this series, the main characteristics of each type, the specifications, performance data, and production figures are tabulated. The accessories for types A, D, E, J, and S are listed with the name of the manufacturer and part number. Specifications and performance of the Wright Cyclone 14R-2600 are offered for comparison.

Flight Tests of Slide Valve Engine Jumo 210. H. Denkmeier. (*Deutsche Versuchsanstalt für Luftfahrt, DB/JUM 210*, February 8, 1943.) *U.S., Army Air Forces, Translation No. F-TS-3072-RE*, May, 1947. 2 pp.

The rotary valve Jumo 210 was installed in the center position on the Ju 52 three-engined bomber. The engine had been operated for 200 hours on the test stand and was then completely overhauled. Starting was difficult at temperatures below zero unless acetylene was injected into the boost air. Except for a crack in the crankcase the engine was in good condition after 200 hours of test-flying.

Problems of Helicopter Power Plants. Robert Insley. *Western Flying*, Vol. 27, No. 6, June, 1947, pp. 19, 30, 36. (Extended abstract of a paper.) (Cf. AER 6/47:41.)

Major Design Features of the Rolls Royce 3500 Hp. Engine (Eagle). W. F. Bradley. *Automotive and Aviation Industries*, Vol. 96, No. 11, June 1, 1947, pp. 32–35, 56, illus. (Cf. AER 8/47:43.)

Engines, Rocket

The Problem of Escape from the Earth by Rocket. Frank J. Malina and Martin Summerfield. *Journal of the Aeronautical Sciences*, Vol. 14, No. 8, August, 1947, pp. 471–480, figs. 14 references. (*See* AER 4/47:29.)

On the Theory of Rockets. J. Ackeret. (*Helvetica Physica Acta*, April, 1946, pp. 103–112.) *British Interplanetary Society, Journal*, Vol. 6, No. 4, March, 1947, pp. 116–123, figs. 2 references.

Precise formulas are derived for extremely high jet velocity by using the relativistic rocket theory. These formulas become applicable when the final velocity of the rocket exceeds one-tenth of the speed of light. From the formulas it can be shown that the nuclear fission of Uranium 235 can produce sufficient energy for an interplanetary journey to Venus or Mars.

Problems in Rocket Development. J. Humphries. *British Interplanetary Society, Journal*, Vol. 6, No. 4, March, 1947, pp. 100–116, diagrs.

The efficiency of nozzles, injectors, and combustion chambers is now so high that future development in efficiency of rocket engines will probably lie in the improvement of fuels. The products of combustion of fuels containing H, C, and N impose a limit of 3,500°C. on operating temperatures and make it unlikely to attain specific impulses above 300 sec. A table presents fuel combinations that may solve this problem. The difficulties caused by the higher temperatures that accompany higher specific impulses may be overcome by the use of ceramics, film cooling, and porous metals.

Some Energy Considerations. Derek F. Lawden. *British Interplanetary Society, Bulletin*, Vol. 2, No. 3, April, 1947, pp. 41–43.

An analysis of the distribution of energy produced by a rocket fuel between the rocket itself and the exhaust gases. Maximum energy is transferred to the missile when the duration of the thrust is small. Energy transfer that is 100 per cent efficient can be obtained only when the combustion is instantaneous.

Letter to the Editor. Ralph H. Upson. *Journal of the Aeronautical Sciences*, Vol. 14, No. 8, August, 1947, pp. 469, 470, 488, figs.

A practical basis for the efficiency of a rocket in flight outside the atmosphere can be the kinetic energy of the residual mass after the discharge of the fuel energy and its accompanying mass. Since part of the expended energy accelerates the unexpended fuel and some energy remains in the expended mass, the efficiency will never be unity. Maximum efficiency will be attained when the mass discharged is about four times the total mass of the rocket with useful load.

Rocket Formulae. H. E. Ross and R. A. Smith. *British Interplanetary Society, Journal*, Vol. 6, No. 4, March, 1947, p. 124.

Formulas and transpositions that can be used to extract a basis of comparison from the various forms in which rocket performance data are commonly presented. Terms and symbols are defined.

Rocket Propulsion. II—The Vickers-Armstrong Project—Pilotless Aircraft for Transonic Research. K. W. Gatland. *Newnes Practical Mechanics*, Vol. 14, No. 163, April, 1947, pp. 228–231.

Technical Notes on German Rocket Development. I. Eric Burgess. *British Interplanetary Society, Bulletin*, Vol. 2, No. 3, April, 1947, pp. 49, 50.

The numerical classification used by the Reichsluftfahrtministerium (German Air Ministry) for turbojet, turboprop, and rocket units. A list of 23 rocket units by the German classification numbers gives the manufacturers' names, fuels, and tactical employment of the rockets. Other jet power units and rocket missiles to which no number had been assigned are also listed. The composition and code names of ten rocket fuels are given.

The HWK 109-507 Bi-Fuel Rocket Unit. Eric Burgess. *Pacific Rockets*, Vol. 1, No. 4, March, 1947, pp. 6–8, illus.

The propulsion of the guided missile Hs 293 was accomplished by a Walter liquid-fuel unit that used T-stoff (hydrogen peroxide) and Z-stoff (aqueous solution of sodium or calcium permanganate). This unit operated on the Walter "cold" cycle.

Fire Prevention

Some Causes of False Alarms in Aircraft Fire-Detector Systems. R. E. Carbauh. *Air Transport*, Vol. 5, No. 6, June, 1947, p. 84.

Hangar Fires of 1946. *Aero Digest*, Vol. 54, No. 4, April, 1947, pp. 40, 41, 140–142, illus. Factual information regarding the causes of hangar fires in the United States during the year 1946.

Flight Technique

The Circling Method of Holding and Letting Down. Kenneth V. Beer. *Air Transport*, Vol. 5, No. 6, June, 1947, pp. 43–45, figs. A method of using the automatic direction-finder which gives simple, accurate, and rapid instrument orientation and station location.

Cross-Wind Landings. Ralph S. Johnson. *Air Transport*, Vol. 5, No. 6, June, 1947, pp. 24–26, illus.

Flight Testing and Performance

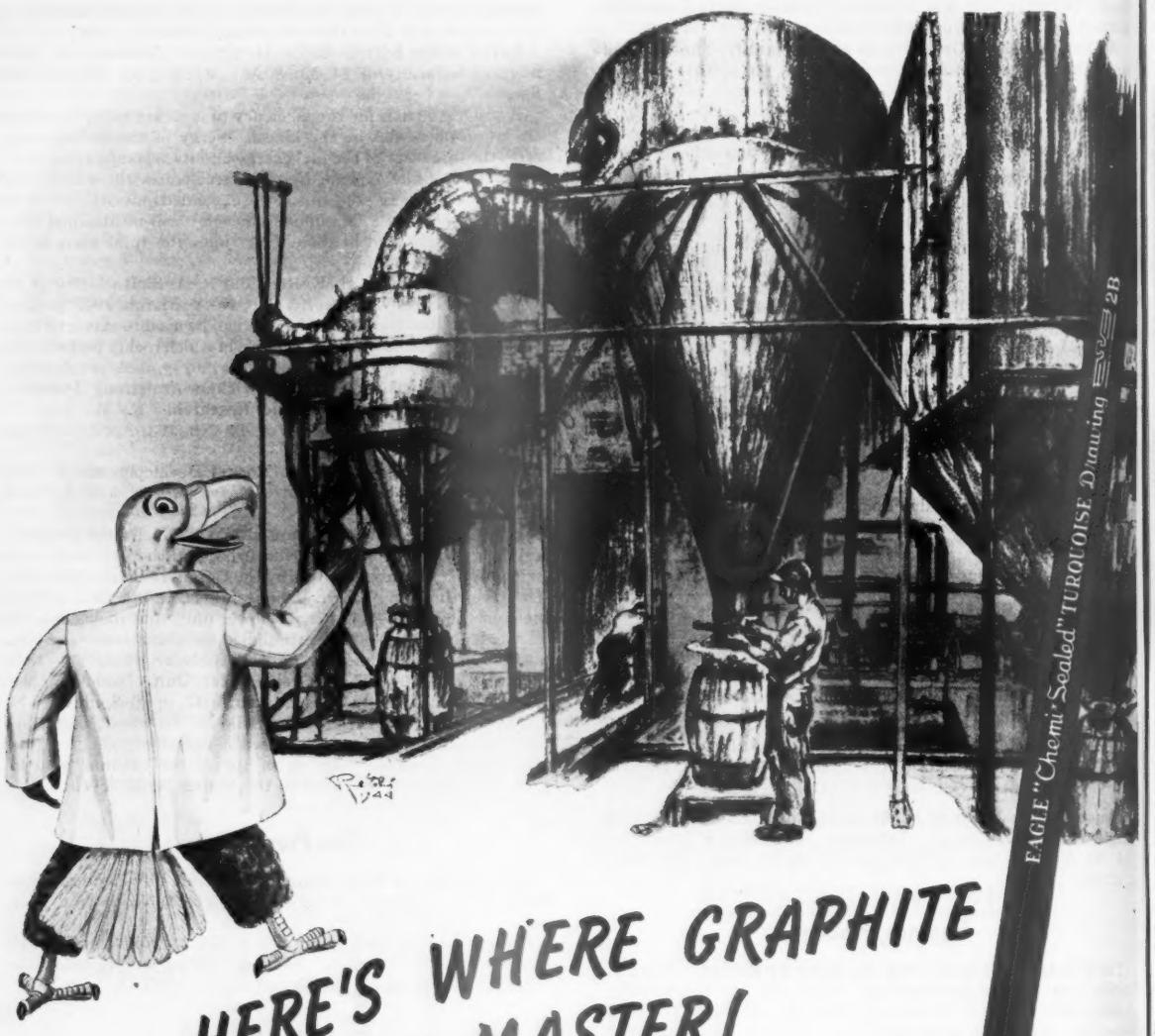
Operational Aerodynamics of High-Speed Transport Aircraft. R. S. Shevell. *Douglas Aircraft Co., Inc.* (For abstract see "I.A.S. Briefs" on page 31 of this issue, September, 1947.)

Performance Calculation for Jet-Propelled Aircraft. R. K. Page. *Royal Aeronautical Society, Journal*, Vol. 51, No. 437, May, 1947, pp. 440–450, figs.

An analytical method of calculating the speed and climb performance of jet-propelled aircraft when the drag and thrust are known. A method is given for dealing with the effects of compressibility. A typical example is worked out to illustrate the types of curves obtained when compressibility is ignored and when compressibility is taken into account.

Experimental Verification of Two Methods for Computing the Take-Off Ground Run of Propeller-Driven Aircraft. Welko E. Gasich. *U.S., N.A.C.A., Technical Note No. 1258*, June, 1947. 33 pp., illus. 3 references.

Data obtained from take-off ground-run tests on a number of propeller installations representative of present practice are com-



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pared with the results obtained from computations based on simplified assumptions used in Diehl's method and the results obtained by the use of a more detailed method developed in this paper. In most cases the ground-run values calculated by Diehl's approximate method agreed with experimental values within ±7 per cent but were in error as much as 15 per cent for a propeller operating at an unfavorable power loading. Improved procedures for thrust computation are required before any more rigorous method may be substituted profitably for Diehl's approximate method.

Wind-Tunnel Investigation of the Effect of Power and Flaps on the Static Lateral Characteristics of a Single-Engine Low-Wing Airplane Model. Vito Tamburello and Joseph Weil. *U.S., N.A.C.A., Technical Note No. 1327*, June, 1947. 76 pp., diagrs. 7 references.

Flight Investigation of the Effects on Airplane Static Longitudinal Stability of a Bungee and Engine-Tilt Modifications. George A. Rathert, Jr. *U.S., N.A.C.A., Technical Note No. 1260*, May, 1947. 32 pp., diagrs. 4 references.

The "bungee" modification, a spring force applied to the elevators to obtain an improved stick-free longitudinal stability, proved to be more satisfactory than the inclined thrust axis obtained by tilting the engine. The effects of both the bungee and the engine tilt could be calculated with sufficient accuracy for a preliminary evaluation of the installations. An appendix gives a simple flight-test method of selecting the bungee installation that is necessary to correct given unsatisfactory stick-free stability characteristics.

Air Speed Conversion Chart and Equivalent Air Speed v. Mach Number Chart. *Aircraft Engineering*, Vol. 19, No. 219, May, 1947, p. 146.

Fuels

Fuels and Lubricants for Aero Gas Turbines. II. C. G. Williams. *Shell Aviation News* (London), No. 107, May, 1947, pp. 14–21, figs. (Cf. AER 8/47:45.)

A detailed discussion of flame-tube research on different types of fuels. A consideration of the high- and low-temperature requirements of turbine engines, cold starting, fire hazard, and the availability of turbine fuels leads to the conclusion that the relatively low viscosity and high volatility of a distillate fuel having a boiling range of 65°–300°C. offers considerable advantages in relation to atomization, cold starting, blowout, and carbon deposition. Fuel of this type could be made available in large quantities.

Underwing Fueling and How It Was Engineered. Eric Olsen. *Aviation*, Vol. 46, No. 6, June, 1947, pp. 37–39, illus.

The Collaps-a-Hose pump unit (Wayne Pump Co.) can deliver 200 gal. per minute to a wing tank with less attendant vapor and less entrapped air than standard overwing methods. The pump is controlled by an electronic circuit that can be preset for a desired quantity. When this amount is reached, the pump is automatically reversed and the hose scavenged. The intake port of the tank closes automatically when the tank is full.

The Separation of Ethylene from Higher Hydrocarbons by Activated Charcoal. Schoellig. (*IGF/L/Mit/K/40/43*, October, 1943.) *U.S., Army Air Forces, Translation No. F-TS-988-RE*, May, 1947. 19 pp., figs.

Gliding and Soaring

The Trend of Sailplane Design. II. L. P. Moore. *Sailplane and Glider*, Vol. 15, No. 5, May, 1947, pp. 4, 5, diagr. (Cf. AER 6/47:43.) Gliders will have to become smaller and two-place models will adopt the tandem tailless design. Rocket-assisted take-off can eliminate the necessity for towing.

Wolf Hirth's Engine Assisted Sailplane, the HI 20. (*Flugsport*, September, 1944.) *Sailplane and Glider*, Vol. 15, No. 5, May, 1947, pp. 15, 16, illus.

A 25-hp., two-stroke, four-cylinder engine, designed by W. Krautter of Stuttgart, is mounted, together with the propeller and gearing, on a strut that can be retracted into the fuselage. The propeller is so positioned that the slipstream hitting the elevators cancels exactly the nose-heavy effect of the pusher propeller. The glider made its first flight in 1941.

Convections and the Soaring Pilot. II. H. Neubroch. *Sailplane and Glider*, Vol. 15, No. 5, May, 1947, pp. 2, 3. (Cf. AER 7/47/49.)

Thunder clouds, which may extend as high as 30,000 ft., may be used by a glider pilot to obtain altitude. Observations made during the Roen contest in 1938 indicate that vertical currents may start a few hundred feet below the base of the cloud and rise smoothly through the center of the cloud until an area of violent turbulence is reached. Icing may occur between 15,000 and 25,000 ft. Low temperatures make it necessary to provide cockpit heating.

Guided Missiles

Instrumentation of Guided Missiles; Applications and Limitations. Lester G. Zukerman. *Hughes Aircraft Co.* (For abstract see "I.A.S. Briefs" on page 29 of this issue, September, 1947.)

Full-Scale Free-Flight Ballistic Measurements. L. A. Delsasso, A. L. G. de Bey, and D. Reuyl. *Aberdeen Proving Ground.* (For abstract see "I.A.S. Briefs" on page 28 of this issue, September, 1947.)

Pressure Recovery for Missiles with Reaction Propulsion at High Supersonic Speeds (The Efficiency of Shock Diffusers). Kl. Oswatitsch. (*Göttingen, Forschungen und Entwicklungen des Heereswaffenamtes, Bericht Nr. 1005*, January, 1944.) *U.S., N.A.C.A., Technical Memorandum No. 1140*, June, 1947. 58 pp., illus. 3 references.

The atmospheric air compressed at the nose of the missile in a compression shock cone is introduced into the interior of the missile where it is further compressed by more shocks. The air is slowed down until it reaches subsonic velocity. Still further compression is effected by a subsonic diffuser through which the air reaches the combustion chamber. The maximum air pressure that can, in theory, be attained in the combustion chamber of a missile flying in the free atmosphere at two and nine-tenths times the speed of sound is 31 atmospheres absolute. In practice, however, a pressure of only 11 atmospheres can be attained. The use of a simple duct in the nose of the missile and a shock diffuser described here make possible a pressure of 19 atmospheres absolute.

Radial Acceleration of an Automatically Guided Body in Relation to the Response of the Control System. John, Jung, Hornauer. (*Electoacustic K.G., BV-Misc./67.*) *U.S., Army Air Forces, Translation No. F-TS-1068-RE*, April, 1947. 37 pp., figs.

Contains four separate papers. In the first paper, "Radial Acceleration of an Automatically Guided Body in Relation to the Response of the Control System," formulas are developed for the radial acceleration of a target-seeking missile under the assumption that the motion of the target and the trajectory of the missile lie in the same plane. The second paper, "Microphone in an Acoustic Control Mechanism for 'Vesuv,'" treats the factors that led to the selection of an electrodynamic type of microphone for use with this guided missile. A double microphone with two receiving membranes 180° apart permits the solenoids to be connected so that when the membranes vibrate in opposite directions, the voltage is added, and, when they vibrate in the same direction, the voltage is subtracted. Body noise sensitivity is reduced by a factor of 10.

The third paper is entitled "The Use of Receiver Voltages for Transmitting Direction-Dependent Control Commands." If the sound originating from the target hits the center plane of the receiver base, the voltage of the two component receivers of each base will be identical and in the same phase. If, however, the incidence of the sound is in a different plane, there will be a phase shift between the voltages proportional to the angle of incidence of the sound. These voltages are amplified and relayed to the stator-solenoids of a rotary-field relay. The solenoids are separated by an angle of 90°. The relay operates according to the Ferraris principle and establishes contacts by turning the armature to the right or left, operating the control mechanism according to the direction of the phase shift.

The fourth paper, "Report on a Discussion of the Askania-Werke A.G.," is the minutes of three meetings held by a subcommittee of Special Controls group of the receiver-converter section to consider the design of a basic electrical cirucit for control mechanisms. The committee was to attempt to eliminate, where possible, multicontact screw plugs and receptacles and to select a design for multicontact knife plugs that would allow maximum interchangeability.

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MARTIN 2-0-2 approved by the Civil Aeronautics Administration . . . the recommendation of CAA's Type Certification Board that the CAA Washington Office issue a type certificate to the 2-0-2 means that this advanced new airliner has been given the okay of the U. S. Government . . . that its great speed, comfort and dependability will be available to airline passengers *now!* Delivery of the first of Northwest Airlines' fleet of Martin 2-0-2's has been made. Deliveries to other leading North and South American airlines will follow soon.

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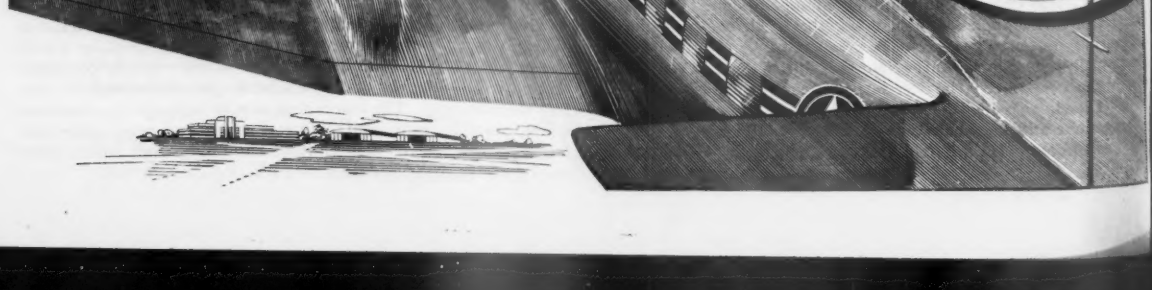


Measurements of Base Pressure on a Missile in Free Flight. F. K. Hill and R. A. Alpher. *Journal of Applied Physics*, Vol. 18, No. 5, May, 1947, p. 489, diagrs.

Missiles containing telemetering apparatus have been rocket-launched at supersonic speeds to obtain base pressure data that can be used to correct for scale effect in wind tunnels. Results from tests of two missiles show that the base pressure coefficient drops sharply as Mach Number = 1 is reached and that at supersonic velocities this coefficient shows small variations in the vicinity of Mach Number = 3.

Super Altitude-Research Rocket Revealed by Navy. C. H. Smith, Jr., M. W. Rosen, and J. M. Bridger. *Aviation*, Vol. 46, No. 6, June, 1947, pp. 40–43, illus.

Engineering study of the design and calculated performance of the Martin HASR-2 Neptune rocket.

Haywire Rocket. Willy Ley. *Air Trails and Science Frontiers*, Vol. 28, No. 4, July, 1947, illus.

An informal account of the firing of the A-4 rocket Number 14 at White Sands Proving Ground, N.M., on November 6, 1946. The rocket was intended to carry cosmic ray counters to an altitude of 123 to 125 miles. The rocket malfunctioned and reached an altitude of about 1,100 ft.

Giant Rocket Test Center Planned for California Desert. *Aviation News*, Vol. 7, No. 23, June 9, 1947, p. 13.

El Centro, Calif., has been selected as the site for an air-missile testing center that will exceed in importance the centers now located at White Sands, N.M., and at Pt. Mugu, Calif. The location at El Centro will provide an 800-mile calibrated range down the Gulf of California. Flight recording stations will be installed along the coasts of Lower California and Mexico proper.

History

The History of the Brittania Trophy. Goeffrey Dorman. *Aeronautics*, Vol. 16, Nos. 4 and 5, May–June, 1947, pp. 54–57, illus.

The Brittania Trophy is awarded annually by the Royal Aero Club to the British aviator who has achieved the most meritorious performance in the air during the preceding year. The achievements for which the trophy has been awarded are described in chronological order from 1913 to 1946.

Ice Prevention

Report on the Development and Application of Heated Wings. Myron Tribus and J. R. Tessman. *U.S., Army Air Forces, Technical Report No. 4972, Addendum No. 1*, January 9, 1946. 129 pp., illus., diagrs., figs. 22 references.

The first section of the report is a nontechnical account of the research program and its progress. The second section is a detailed explanation of the data as interpreted at present. The adoption of heated surfaces for ice prevention made it necessary to obtain accurate quantitative data to determine heat transfer coefficients for air flowing in the double skin heating structure and for air flowing over the outer surface of the aircraft. The size and number of droplets in an icing cloud had to be measured and analyzed, and the formula for the interception of drops by an airfoil had to be derived.

Flights were made in icing conditions and in clear air. A specially modified test airplane was used to obtain data under natural icing conditions. A heated airfoil section was mounted above the fuselage at the longitudinal center of gravity and fitted with thermocouples to measure surface, structural, and air temperatures. The cloud deck was first surveyed to obtain the meteorological data; this was accomplished with the airfoil heated to prevent ice. After this survey, runs were made in the clouds at altitudes where the icing rate appeared to be highest and where icing conditions would be continuous for a period long enough to take all the data needed.

At the same time the test flights were being conducted, observations were being made at the Mount Washington Observatory in New Hampshire. In order to guide the experimentation, analytical studies were made of the trajectories of cloud droplets in the neighborhood of a moving cylinder. A theoretical investigation of aerodynamic heating indicated that at very high speeds there is a decrease in heating requirements which greatly affects the weight of the heating equipment required. The point-to-point variations in heat-transfer coefficients inside the heating element of a typical heated wing were determined. It was found that there was a heat-transfer factor of two caused by conduction effects in the double skin which had heretofore been disregarded.

The trajectories of droplets near cylinders were calculated and verified for speeds up to 209 m.p.h. A valid technique for calculating the trajectories near airfoils was established. Tables were prepared for convenient computation of the rates of evaporation from a wing surface given the surface temperature, free air temperature, altitude, and clear-air heat-transfer coefficients. With this information the heat required for ice prevention on wings of various sizes under differing speeds and icing conditions can be predicted. Thus it is possible to design heated wings for the desired heat transfer and to obtain the maximum benefits from ice-prevention equipment of a given weight.

Thermal Anti-Icing. *Douglas Service*, Vol. 5, No. 6, June, 1947, pp. 1–6, diagrs.

The DC-6 thermal anti-icing system is an integral part of the leading edges of the wing and tail surfaces. Scoops located in the wings and the empennage supply air to the system. After passing through the heaters, the air is conducted along the leading edges of the wing and tail and then is ducted chordwise and escapes at the trailing edge. Schematic diagrams show the fuel pump, ignition, and overheat relay circuits of the wing and empennage systems.

Instruments—General

The Definition of Distortion in Optical Instruments for Subjective Observation. H. Slevogt. *Gt. Brit., Ministry of Supply, RTP/TIB Translation No. G.D.C. 3A/1T.* 9 pp., figs.

Instruments, Engine

A New Approach to the Torquemeter Problem. K. W. Miller. *Automotive and Aviation Industries*, Vol. 96, No. 11, June 1, 1947, pp. 36, 37, illus.

Torque is measured by detecting magnetic and electrical changes caused by torsional stress in a thin metal film overlay that is applied to a short axial length of the standard shaft's surface. The pickup contains two helical coils located coaxially with the shaft. An electric current passed through these coils sets up flux linkages in the outer layer of the shaft. A change in stress causes a variation in the flux and a change in impedance. This effect is translated to provide a torque-proportional output current that actuates a meter or oscillograph calibrated in terms of torsional stress.

Torque Measuring Device Utilizes Compressed Air. *Automotive and Aviation Industries*, Vol. 96, No. 11, June 1, 1947, pp. 41, 94, diagrs. (Abstract of: *U.S., N.A.C.A., Restricted Bulletin No. 4C28*, March, 1944, The NACA Balanced Diaphragm Dynamometer-Torque Indicator, Charles S. Moore, Arnold E. Biermann and Fred Voss.)

A Low-Speed Tachometer. Edward C. Blom. *Instruments*, Vol. 20, No. 5, May, 1947, p. 448, diagrs.

The difficulties caused by the low voltages generated by conventional tachometers at speeds between 1 and 600 r.p.m. and by the film that develops on the commutator or slip rings of brush-type generators running at low speeds can be overcome by using a two-phase drag-cup motor. The motor is operated as a generator with an a.c. voltage applied across one of the two windings. The a.c. voltage induced in the other winding will be proportional to the speed of the shaft for low speeds. The induced voltage is amplified to the level desired and made to operate relays or to move a recording pen.

Instruments, Flight

Blind-Approach Presentation. G. H. Parkes. *Flight*, Vol. 51, No. 2002, May 8, 1947, pp. 418–420.

A viewer presents a motion picture of an ideal beam approach to a given airport. Any deviation of the aircraft from the beam is indicated on the screen of the viewer by the blacking-out of the appropriate margin of the picture. A picture of the dials of the altimeter and of the air-speed indicator is projected at the bottom of the screen to avoid the necessity of the pilot's shifting his attention to the instrument board.

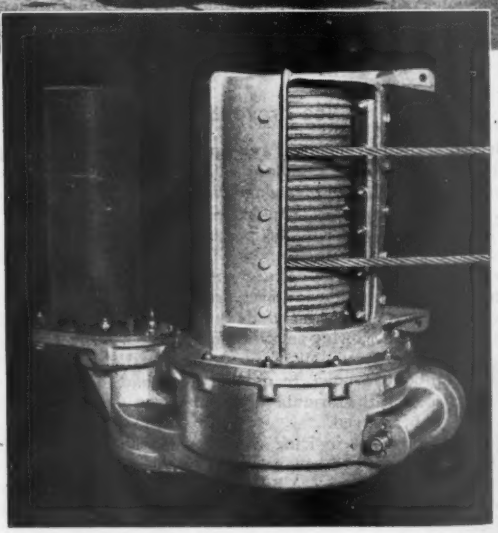
LESS time on the Ground Means MORE Revenue in the Air

Photo shows the PACIFIC-WESTERN built cargo hoist actuator mounted in the nose of the cargo appendage which becomes part of the Constellation when in flight.

PACIFIC-WESTERN'S model 130400 cargo hoist actuator speeds cargo loading time on the "Speed Pak" of the huge Lockheed Constellation. This detachable cargo carrying unit is preloaded, moved under the plane and then hoists itself into position on the underside of the fuselage by means of the PACIFIC-WESTERN cable drum type actuator. Driven by a three horsepower electric motor, this 1508:1 ratio actuator spools four cables at once, weighs only 70 pounds but is capable of lifting five tons.

This is another example of many applications for a wide variety of power transmission problems which are regularly solved by our engineering department.

Let our engineers give you a "lift" on your gear problems.



Compact . . . rugged . . . reliable . . . our Model 130400 actuator loads 5 tons in 30 seconds on the Constellation.

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AGMA MEMBER

The Functions of an Angle of Attack Indicator. *Western Flying*, Vol. 27, No. 6, June, 1947, pp. 21, 28, 30. (Cf. AER 6/47:45.) Description of the Kollsman angle-of-attack indicator.

Instruments, Meteorological

Fins for Aerological Instruments. Maurice A. Garbell. *The Journal of Meteorology*, Vol. 4, No. 3, June, 1947, pp. 82–90, diagrs. 5 references.

An analysis of the manner and degree in which the lift and drag of fins concur in producing stability and damping in direction-indicating fluid-flow-measuring instruments. The measure in which toed-in fins increase, and in certain configurations decrease the fin effectiveness and the useful stable range of angles of yaw, is viewed critically. An arrangement of inward-facing fins with certain chambered airfoils affords a sharp profile-drag increase at negative angles of attack immediately below the angle of zero lift. This permits satisfactory values of static stability and rotary damping to be attained while reducing the fore-and-aft "tail length." This reduction reduced the infringement time lag in the response of flow-direction-indicating aerological and hydrological instruments.

Insurance, Safety, and Rescue

The Adequacy of the Passenger Liability Limits of the Warsaw Convention of 1929. J. Brooks and B. Parker. *The Journal of Air Law and Commerce*, Vol. 14, No. 1. Winter, 1947, pp. 37–43.

Several countries have not ratified the Warsaw Convention of 1929 in its present form with its present liability limit of $8,291.87 per passenger. If this limitation were increased, it is reasonable to believe that these countries would not sign the new convention, and were it increased to anything that British and American practice would require, few of the other countries would ever ratify it. The entire Warsaw Convention should not be opened lest the air lines lose these practical limits that now exist.

Insurance Aspects of Air Navigation. Jerome Lederer. *Preprint, Institute of Navigation Eastern Regional Meeting*, New York, February 14, 1947. 6 pp.

An outline of the types and amounts of insurance that could be involved in the crash of an airliner. It is proposed that aircraft be installed with radio transmitters, which, in the event of a crash, would be detached from the aircraft and would transmit a distress signal automatically.

Underwriting Memorandum on Airline Accidents. *Transportation Insurance Rating Bureau, Chicago, Aircraft Bulletin*, Vol. 7, No. 9, June 17, 1947. 7 pp.

The Civil Aeronautics Board reports on crashes in recent years reveal no new accident causes. Many crashes have resulted from company negligence in not setting up proper safety procedures, deliberate taking of chances by pilots, and occasional flagrant violations of company and C.A.A. regulations. Five common faults in the operation of scheduled air lines are said to be: deviation from the airway, deviation from prescribed altitudes, inattention to approach procedures, faulty maintenance, and lack of adequate training and supervision of flight and ground personnel. Three essential remedies are proposed: Government enforcement of its regulations, enforcement by the air lines of their own procedures and regulations, and the establishment by the industry as a whole of an "office of flying safety" similar to that operated by the Army Air Forces during the war.

The Auliff Lifebelt. *The Technical Instructor* (Society of Licensed Aircraft Engineers, London), Vol. 2, No. 4, April, 1947, pp. 13, 14.

Description of the Auliff Lifebelt, an approved type for use in civil aircraft, consists of a rubberized twill tube that is inflated from a tube containing a charge of compressed gas. Directions are given for inspection of the belt and its use.

Landing Gear

Note on the Reduction of Landing Distance by the Use of the Tricycle Undercarriage. J. R. Ewans. *Gt. Brit., Aeronautical Research Council, Reports and Memoranda No. 2116*, March, 1939. 6 pp., figs. 4 references.

The replacement of a conventional by a nose-wheel undercarriage should lead to a reduction in the landing distance by eliminating float and by making it possible to use more powerful brakes. When landing with an unbraked nose wheel and smooth tires on a grass runway at minimum approach speed, the landing run of a tricycle landing gear will be greater than that of a conventional landing gear. At normal approach speed the landing distance will be the same as that of a conventional craft. At an approach speed 50 per cent above the stall the three-wheel undercarriage would reduce the landing distance. If, however, all three wheels are braked, the tricycle will save 20 per cent of the landing distance at the normal approach speed. As the excess speed on the glide becomes greater the distance saved by the tricycle undercarriage increases; thus the range of approach speeds may be much greater than with conventional undercarriage and the judgment of the approach may be easier.

The German View of the Tricycle Undercarriage; An Article Edited and Prepared with Comments by H. G. Conway from a German Report by Toennies and Gollung (Research Group for Tricycle Undercarriages—Interim Report, 1944), Issued by the Ministry of Supply as R.T.P./T.I.B. Translation No. G.D.C. 3E/3T. *Aircraft Engineering*, Vol. 19, No. 219, May, 1947, pp. 147–149, diagrs.

This report, which covers nose-wheel loading and braking, trail or caster effects, shock absorber characteristics, tires, shimmy and shimmy dampers, includes much detailed information on the handling characteristics of the various aircraft involved.

Lubrication and Lubricants

Investigation of a Synthetic Lubricating Oil of the Ruhr-Chemie A. G. in the Hot-Cooled Single-Cylinder Test Engine. K. Dehn. (*Deutsche Versuchsanstalt für Luftfahrt, ZWB/FB/804*, April 16, 1937.) *U.S., Army Air Forces, Translation No. F-TS-938-RE*, April, 1947. 18 pp., illus.

The synthetic lubricating oil of the Ruhr-Chemie "SO 2001, improved quality" was compared with "Stanavo 140" in the hot-cooled BMW-VI single-cylinder test engine. For the oil of Ruhr-Chemie the period until the piston rings seized was considerably longer than for the reference oil. Especially notable also was the low wear of the piston rings in the test run of the synthetic oil. The testing of oil samples taken after running times of 10, 25, 35, 50, 70, 80, and 90 hours showed generally normal aging. The increase of the saponification number, however, is unusually high.

Determining Consistency on Small Samples of Lubricating Grease. R. F. McKibben. *American Society for Testing Materials, Bulletin, No. 146*, May, 1947, pp. 74–77, illus. 3 references.

The materials laboratory of the National Cash Register Company has developed a "disk viscometer," which tests lubricant samples as small as 4.2 mg. by measuring the torque transmitted by a rotating disc through a film of the lubricant to an opposing, balance-restrained, rotating disc. Operators are able to repeat determinations on a given sample within 14 per cent and to reproduce another's work within 19 per cent.

German Methods for Determining Lubricity of Oils and Greases (Project No. DP-151). W. W. Windisch. *U.S., Army Air Forces, Technical Report No. F-TR-2139-ND*, May, 1947. 24 pp., illus. 5 references. A collection of translations describing 16 test devices used in Germany in an attempt to establish a numerical value for the degree of lubricity displayed by a lubricant.

The Hydrodynamic Lubrication of Finite Sliders. Charles P. Boegli. *Journal of Applied Physics*, Vol. 18, No. 5, May, 1947, pp. 482–488, figs. 8 references.

A refinement and expansion of a work originally published as *N.A.C.A. Advance Restricted Report No. E4122*. Two approximations are made in the solution of Reynold's lubrication equation for the case of a finite slider. These approximations lead to a series of equations that are easy and rapid to use for flat sliders and which are also applicable to curved sliders. Examples of their use are given. A number of calculations determine the range of slider proportions to which they may be applied with sufficient accuracy. This method is of special value for wide sliders that are difficult or impossible to analyze by other methods.

Maintenance

Some Aspects of the Repair of the de Havilland Mosquito. A. J. Brant. *Aircraft Engineering*, Vol. 19, No. 219, May, 1947, pp. 163–174, illus.

No Radio "Noise Nuisance" in the Martin 2-0-2 . . . thanks to American Shielding Conduit

THE GLENN L. MARTIN COMPANY'S new "2-0-2" transport, soon to be a familiar sight at all of the nation's commercial airports, has the added safety of shielding with American HTCD Conduit.

This extensive use of HTCD Shielding Conduit eliminates all possibility for radio "noise nuisance" in primary leads, ignition and other wiring. For the latter wiring alone, American furnished 23 tailor-made shielding units —varying in length from 5" to 350".

American HTCD Shielding Conduit —approved by both the Army and Navy—is built to combine exceptional mechanical strength with the ultimate in electrical shielding characteristics. For these qualities, "HTCD" has been acclaimed by thirteen leading American, and many foreign, airline operators as the outstanding ignition shielding available today.

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An inner core of fully interlocked stainless steel flexible tubing is covered with two carefully designed layers of tinned copper wire braiding. A molded synthetic cover gives complete protection against dirt, dust, oil and other foreign substances.

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The fuselage and the wing of the Mosquito were originally manufactured in one piece and were not readily detachable. This necessitated more extensive field repairs than were usually made on metal aircraft that had detachable fuselage sections and detachable port and starboard wings. The unavailability of whole fuselages and wings as replacement parts led to the cannibalizing of totally damaged aircraft. The use of synthetic resins in the field presented heating problems that were solved by the use of specially designed tents, electric blankets, and radiant heating. Diagrams of typical damage and detail repair specifications are numerous.

Servicing and Maintenance. Basil Jackson. *Flight*, Vol. 51, No. 2002, May 8, 1947, pp. 410, 411, diagr.

Ease and efficiency of maintenance depends on the design of the aircraft. If this problem were given due consideration during the initial stages of design, subsequent major modifications might be avoided.

Maintenance Job Methods. V—Electrical Systems. James M. Linde. *Air Transport*, Vol. 5, No. 6, June, 1947, pp. 35, 36.

An outline of the adjustment and operation of the generator system of the Douglas DC-4 and the run-up, check, and emergency operation of the generator system of the Lockheed Constellation.

Enterprising Service Has No Limits. Scholer Bangs. *Aviation*, Vol. 46, No. 6, June, 1947, pp. 89, 90, 92, 94, illus.

The activities and organization of the Burbank, Calif., plant of the Pacific Airmotive Corp., which is engaged in the maintenance and overhaul of aircraft and components, the distribution of aircraft equipment, and the production of special test equipment and tools.

Inspection Sign-Off in Transport Conversion. Willis L. Nye. *Airports*, Vol. 11, No. 6, June, 1947, pp. 35, 36, illus.

The inspection sign-off sheet serves as a permanent record of the work done, by whom, and by whom inspected. In addition to fulfilling Civil Air Regulations, it can serve as a check list to coordinate work sequence and as evidence of work actually performed.

Materials—General

Locking Fasteners: An Analysis of Self-Locking Fasteners Now Available for Use in Machine Elements. Harry Raech, Jr. *Machine Design*, Vol. 19, No. 6, June, 1947, pp. 128–132, 184, illus.

The Electrochemical Industry in the Area of Bitterfeld, Germany. R. M. Hunter. *Combined Intelligence Objectives Sub-Committee, Item No. 22, File No. 24–22*, May, 1945. 37 pp. British Information Services, New York. $1.00.

Materials—Metals and Alloys

High Creep Strength Austenitic Gas Turbine Forgings. II. D. A. Oliver and G. T. Harris. *The Engineer*, Vol. 183, No. 4767, June 6, 1947, pp. 502, 503, figs.

Specimens of G.18.B steel were aged for 4,000 hours at 650°–750°C. Both the impact and the tensile strength decreased, while the proof stress and the maximum stress increased. Stress-to-rupture tests at high temperatures indicated that the ductility does not decrease with time and that under creep conditions there is a definite tendency for the percentage elongation at rupture to increase as the rupture time goes up from 22 to 3,000 hours.

Characteristics of Three High Temperature Alloys. J. B. Henry, Jr. *The Iron Age*, Vol. 159, No. 24, pp. 58–64, illus.

S-588 is a nickel-chromium-iron alloy and S-590 and S-816 are iron-chromium-nickel-cobalt alloys that have been proved in practice to be excellent high temperature alloys. The alloys are compared from the standpoint of cost, physical properties, and methods of fabrication, heat-treatment, and machining. The use of vibration tuning-fork samples is suggested as the most accurate criteria for modulus of elasticity measurements.

Magnesium Alloy Developments. *The Aeroplane*, Vol. 72, No. 1879, June 13, 1947, pp. 629, 630, illus.

During the war Essex Aero Ltd. produced magnesium fuel and oil tanks. The principal alloy used contained 2.5 per cent Mn, 94.45 per cent Mg, and 3.05 per cent impurities and was found to have the best welding properties of those investigated. Weight is two-thirds that of aluminum, and strength is nearly the same as that of dural.

The Influence of Calcium on the Grain Size of Magnesium. H. Vosskühler. (*I. G. Farbenindustrie, Versuchsbericht Nr. 96/1940.*) *Gt. Brit., Ministry of Supply, RTP/TIB Translation No. GDC 8/4T.* 2 pp., illus.

The Influence of Various Gases on Cast Elektron. G. Siebel. (*I. G. Farbenindustrie, Versuchsbericht No. 102/1942.*) *Gt. Brit., Ministry of Supply, RTP/TIB Translation No. GDC 9/11T.* 6 pp., figs.

Some Tests Relating to the Magnesium-Hydrogen Effect as Propounded by Dr. Männchen. F. Sauerwald. (*I. G. Farbenindustrie, Versuchsbericht Nr. 96/1942.*) *Gt. Brit., Ministry of Supply, RTP/TIB Translation No. GDC 9/10T.* 4 pp., figs.

Creep Strength of the Elektron Casting Alloys at 150°C. H. Vosskühler. (*I. G. Farbenindustrie, Versuchsbericht Nr. 40/1939.*) *Gt. Brit., Ministry of Supply, RTP/TIB Translation No. GDC 9/3T.* 22 pp., figs.

Notch Effects in High Strength Aluminum Alloys. L. Shapiro. *The Iron Age*, Vol. 159, No. 24, June 12, 1947, pp. 52–56, illus.

A report on the effect of internal and external section discontinuities on the notch sensitivities of aluminum alloys. Ultimate strength of full spar-cap sections of the alloys 14S-T and 75S-T was determined. Bars, plates, and extrusions of alloys 14S-T, 24S-T, and 75S-T were tested in tension. The effect of notch on the limiting strain was determined for extrusions and bars of all three alloys. The tests were confined to axially loaded tension specimens with a single hole, with multiple holes, and with a hole used to apply a load to a member. The stress notch sensitivity was found to be greater for bars than for plates and greater for extrusions than for bars. For any one method of fabrication the order of sensitivity of the material increased in the order: 14S-T, 75S-T, and 24S-T. The tests of strain notch sensitivity indicated that the order of the three alloys was reversed. There was a greater loss of ductility in 14S-T and 75S-T than in 24S-T. 24S-T displayed less strain notch sensitivity than 75S-T.

The Relationship of the Growth Exhibited on Nitriding to the Microstructure of the Nitrided Specimen. II. Lester F. Spencer. *Steel Processing*, Vol. 33, No. 5, May, 1947, pp. 297–303, illus.

Sixteen samples of steel that were given various heat-treatments prior to nitriding are examined to determine the amount of free ferrite present in the sample and its relation to the increase in size of the specimen that is exhibited during nitriding.

Materials—Plastics and Plywood

Ignition Temperatures of Rigid Plastics. E. M. Schoenborn and D. S. Weaver, Jr. *American Society for Testing Materials, Bulletin*, No. 146, May, 1947, pp. 80–87, diagrs. 8 references.

By measuring the actual temperatures that prevail at known points within a specimen at the instant of ignition it is possible to evaluate an apparent ignition temperature for the surface. This temperature value is found to depend primarily on the nature of the substance and upon the temperature of the heat source. At any given furnace temperature, it is shown that the apparent ignition temperature is a function of the time required to ignite the specimen. This relationship is essentially independent of the nature of the materials tested and appears to hold over a wide range of temperatures and times. The probable mechanism of ignition is discussed. A rigorous analysis of the flammability problem is complicated by a lack of information about the thermal properties and the difficulty of applying unsteady-state heat-transfer theory to materials that deform, decompose, or are otherwise thermally unstable at the temperatures involved.

Synthetic Resin Glues. *The Technical Instructor* (Society of Licensed Aircraft Engineers, London), Vol. 2, No. 4, April, 1947, pp. 8–12. Description of the properties and methods of employing Aerolite 306, a urea formaldehyde synthetic resin glue.

Hardness and Abrasion Resistance of Plastics. L. Boor, J. D. Ryan, M. E. Marks, and W. F. Bartoe. *American Society for Testing Materials, Bulletin*, No. 145, March, 1947, pp. 68–73, figs.

Samples of typical commercial plastics were tested for properties associated with the descriptive term "hardness." Included were various indentation, scratch, and wear methods. At least five aspects of behavior, each one contributing in various degrees to the test value obtained by any given method, are indicated.

Materials—Protective Coating

Chemical Notes to the Booklet "Desmophen-Desmodur as Varnish Raw Materials." (*I. G. Farbenindustrie*, March, 1944.) *Gt. Brit., Ministry of Supply, RTP/TIB Translation No. GDC 9/1/T.* 2 pp., diagrs.

Medicine

An Investigation of Errors Made by Pilots in Judging the Altitude of an Aircraft Without the Aid of Vision. *U.S., Army Air Forces, Air Matériel Command, Engineering Division, Aero Medical Laboratory, Memorandum Report No. TSEAA-694-13,* May 2, 1947. 22 pp., diagrs. 2 references.

The misleading character of body sensations and the frequency of illusory sensations offer an explanation for the difficulty reported by pilots in believing their instruments and furnish a partial explanation for the conditions of vertigo that sometimes develop. The findings indicate that ease of interpretation and "naturalness" of sensing should be made a primary requirement on the design of all flight instruments in order to eliminate the need for mental interpretation and provide the pilot with instruments that are easy to believe even when the indications are in opposition to his bodily sensations.

Kinesthesia in Flying. Edwin H. Carnes. *Contact* (Pensacola), Vol. 6, No. 3, July 1, 1947, pp. 201–207.

An analysis of the part played by the pressure sense, vision, proprioception, and the vestibular sense in the pilot's judgments of attitude and motion. Contact flying requires a development of these senses to a high degree, but under certain conditions, and particularly during instrument flying, illusions that they sometimes produce must be recognized and suppressed.

Poor Eyesight and Good Flying. Waldo E. Rassas. *Air Facts,* Vol. 10, No. 6, June 1, 1947, pp. 47–50, 52–55, illus.

Tests conducted by the University of Tennessee to determine the effect of defective vision on the ability of a student to learn to fly seem to indicate that visual acuity sufficient to drive an automobile is sufficient to pilot an airplane.

Aviation Ophthalmology. Brittain F. Payne. *The Military Surgeon,* Vol. 100, No. 6, June, 1947, pp. 488–497, table.

Meteorology

Meteorological Conditions Associated with Flight Measurements of Atmospheric Turbulence. B. B. Helfand. *U.S., N.A.C.A., Technical Note No. 1273,* June, 1947. 33 pp., illus., maps. 4 references.

The results obtained from a series of flight measurements of atmospheric turbulence within convective-type clouds, and data obtained from meteorological soundings are presented together with descriptions of the flights and concurrent weather conditions. The results are intended as a background for the forecaster and pilot by illustrating the turbulence conditions as indicated by effective gust velocities in convective clouds under spring and summer weather conditions along the eastern coast of the United States.

Radar Storm Detection. Raymond Wexler and Donald M. Swingle. *American Meteorological Society, Bulletin,* Vol. 28, No. 4, April, 1947, pp. 159–167, figs. 15 references.

The theory of radar storm detection is derived. The power received from rainstorms varies inversely as the fourth power of the wave length and the square of the range and directly as the summation of the sixth powers of the radii of the droplets effectively illuminated. Rain has a greater reflectivity than clouds not associated with rain by a factor of about 10^6. Absorption by oxygen and water vapor causes attenuation of the radar beam. For 3.2-cm. radiation the experimental two-way attenuation through 10 km. of rain intensities, chosen as light, moderate, and heavy, are approximately 16, 51, and 83 per cent, respectively. For most storm-detection purposes, radar utilizing wave lengths in the vicinity of 3 to 6 cm. is more suitable than 9- to 12-cm. equipment. Through appreciable distances of moderate or heavy rain, use of the 10-cm. radar gives a greater return signal than 3-cm. equipment.

The "Bright Line" in Radar Cloud Echoes and Its Probable Explanation. Horace R. Byers and Richard D. Coons. *The Journal of Meteorology,* Vol. 4, No. 3, June, 1947, pp. 75–81, illus. 4 references.

Observations with 10-cm. height-finding radar of echoes from stratified clouds indicate a horizontal band that produces a stronger return than the parts above or below it. The height of "bright line" occurrence is always at the freezing level and therefore supports the idea of drop formation and, consequently, radar-target formation in the colloidal unstable layer of heterogeneous ice-water mixture. Examples are given from the thunderstorm observation network in the vicinity of Orlando, Fla.

Frontal Contour Charts. A. M. Crocker, W. L. Godson, and C. M. Penner. *The Journal of Meteorology,* Vol. 4, No. 3, June, 1947, pp. 95–99, diagrs. 5 references.

A study of frontal contour charts shows that isolated or semi-isolated domes of cold air and pockets of warm air are found at intervals. The influence of these domes and pockets on the mechanism of general circulation is discussed.

Entrainment of Air Into a Cumulus Cloud. Henry Stommel. *The Journal of Meteorology,* Vol. 4, No. 3, June, 1947, pp. 91–94, figs.

As a cloud rises, air from the environment is drawn in and mixed with the cloud substance, thus modifying the mechanical and thermodynamic characteristics of the cloud. A method is developed for computing the amount of entrainment from the known temperature and the specific humidity inside and outside the cloud. The concentration of water in the form of droplets is also determined.

Some Notes on Visibilities at Salt Lake Airport. William M. Schmalz. *American Meteorological Society, Bulletin,* Vol. 28, No. 4, April, 1947, pp. 179–186, figs. 4 references.

Military Aviation

The War in the Ether. E. B. Addison. *Royal Aeronautical Society, Journal,* Vol. 51, No. 437, May, 1947, pp. 425–436. Discussion, pp. 436–439.

The use of radio and radar to guide military aircraft and to detect the approach of enemy airplanes produced corresponding countermeasures that distort or duplicate guide beams, thus preventing effective approach to a target, and methods of jamming and decoying which reduce the effect of radar installations for

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detecting aircraft. The extensive use of radio countermeasures by the Allies during the Battle of Britain and in the bombing of Germany and the work of special R.A.F. group No. 100, organized to carry out these measures over enemy territory, are summarized.

Navigation

Pressure Navigation. Richard Allen. *The Aeroplane*, Vol. 72, No. 1878, June 6, 1947, pp. 601–603, figs.

The comparison of pressures observed in flight to measure the strength and direction of the wind acting on the aircraft provides the navigator with a reliable means of dead reckoning. This system of navigation, known also as "aerologation" and "pressure pattern flying," is dependent on a true altimeter by which the difference between true altitude and pressure altitude can be measured. The geostrophic wind theory, upon which all forecasting of winds is based, holds that the wind (above 1,500 ft. over water) is parallel to the isobars, and its velocity is directly proportional to the gradient. This equation makes it possible for the slope of pressure along the aircraft's track to be converted to a component of drift. In the same way the slope of pressure at right angles to the track can be measured on the chart to find the head- or tail-wind component. This factor, which can be estimated in advance, makes it possible to select the best-time track. In pressure navigation it is possible to amend a forecast upper-air chart in flight and take advantage of favorable tail winds.

The Dimensions of Flight. A. F. Bonnalie. *U.S. Air Services*, Vol. 32, No. 6, June, 1947, pp. 8, 9, 28.

The relation between the nautical mile and the great circle, which in turn bears a direct relation to time, is intrinsically better adapted to navigation and air transport than the metric system.

Photography

Photography and Photogrammetry "Cross Roads." Paul T. Cullen. *Photogrammetric Engineering*, Vol. 13, No. 1, March, 1947, pp. 95–100. The work of the A.A.F. unit that photographed the Bikini atomic bomb experiments.

Photogrammetric Mapping Operations in Canada. John Carroll. *Photogrammetric Engineering*, Vol. 13, No. 1, March, 1947, pp. 23–32. 5 references.

The Future of Mapping in the Americas. Andre Simonpietri. *Photogrammetric Engineering*, Vol. 13, No. 1, March, 1947, pp. 85–92.

Production—General

Airframe Production. Eric Mensforth. *Institution of Mechanical Engineers, Proceedings*, Vol. 156, No. 1, 1947, pp. 24–38, figs.

An exhaustive study of air-frame production in England during the years 1935–1945. The paper is organized under the following headings: the basis for expansion which existed in the industry in 1935; the general organization of the industry; pre-production, which describes engineering design and development, prototype manufacture, manufacturing control, and the supply position at the outbreak of the war; production, which covers the principal processes, such as machining, fabrication, forming, welding, and assembly; production results; labor; and efficiency. It is shown clearly that economy was achieved by the "group system" of production, under which groups of prime contractors, each as a coordinated whole, built the same aircraft design; by the coordination of the Ministry of Aircraft Production; and by the standardization of aircraft parts and detail components, which was achieved through the Society of British Aircraft Constructors. In the introduction the British industry is compared with that of the United States during the same period.

A Briton Looks at Sweden's Aircraft Industry. I—Aircraft, II—Engines. Richard A. Robbins. *The Aeroplane*, Vol. 72, Nos. 1874, 1875, May 9, May 16, 1947, pp. 480, 483–486, pp. 513–515; illus.

I. The author visited the two major Swedish aircraft manufacturers, Svenska Aeroplan Aktiebolaget and Svenska Flygmotor Aktiebolaget. An outline of the history of the Svenska Aeroplan A.B. mentions the aircraft built between 1931 and 1939. The plant at Linköping is briefly described. A technique of cutting ½-in. plate steel by band saw, in which the back of the saw is used to produce sufficient heat to melt the plate, is mentioned. Specifications are given for the Saab B-18B, 90 Scandia, and the 91 Safir, J-21A.

II. The Svenska Flygmotor A.B. is manufacturing the Daimler-Benz 1,476-hp. aircraft engine. This is to be discontinued, and the Goblin is to be built under license from de Havilland. This plant is also producing a Swedish four-cylinder, twin-opposed 140-hp. engine, the F.451A, for the Safir. A six-cylinder model of the same design develops 210 hp.

Production Methods

Fuselage Frame Production. S. C. Poulsen. *Aircraft Production*, Vol. 9, No. 104, June, 1947, pp. 203–208, illus.

A machine was developed by A. V. Roe and Co., Ltd., which is capable of forming circular frames of almost any diameter from flat strip. It produces a continuous accurately curved section that is cut off periodically at the appropriate point to give complete frames with only one joint. The machine is worked by one operator. Forming and curving of the section are accomplished by rolling, which is carried out in six progressive stages. The first four stages partly form the section, the fifth forms and curves, and the sixth finishes the section to size but does not influence the curvature.

Light-Alloy Castings. J. A. Oates. *Aircraft Production*, Vol. 9, No. 104, June, 1947, pp. 218–223, illus.

A survey of the casting and machining methods used by Wellworthy Piston Rings, Ltd., in the production of aircraft pistons and other parts. Foundry procedure is treated in detail. Facsimiles are reproduced of the master foundry casting card on which are recorded the instructions and data for each different die-cast component and of the foundry operator's instruction card.

Welding of a Large Casting in A9V. M. Schonberg. (*I. G. Farbenindustrie, Versuchsbericht Nr. 89/41.*) *Gt. Brit., Ministry of Supply, RTP/TIB Translation No. GDC 9/8T.* 4 pp., diagr.

Penetration and Welding Speed in Contract Arcwelding. P. C. van der Willigen. *The Iron Age*, Vol. 159, No. 22, May 29, 1947, pp. 70–72, illus.

Weld penetration in the contact arc-welding process is appreciably deeper than with conventional electrodes. The welds are stronger and less subject to undercutting. Heavy electrodes used for the first pass, together with higher heat efficiency of the contact electrode, result in an increase in welding speed of as much as 50 per cent.

The Development of Spot-Welding Processes and Their Applications. Krause and others. (*Weser Flugzeug G.m.b.H., Production Methods Reports, Welding Section, Report No. 1*, October 12, 1943.) *Gt. Brit., Ministry of Aircraft Production, RTP/TIB Translation No. GDC 3E/17T.* 15 pp., illus.

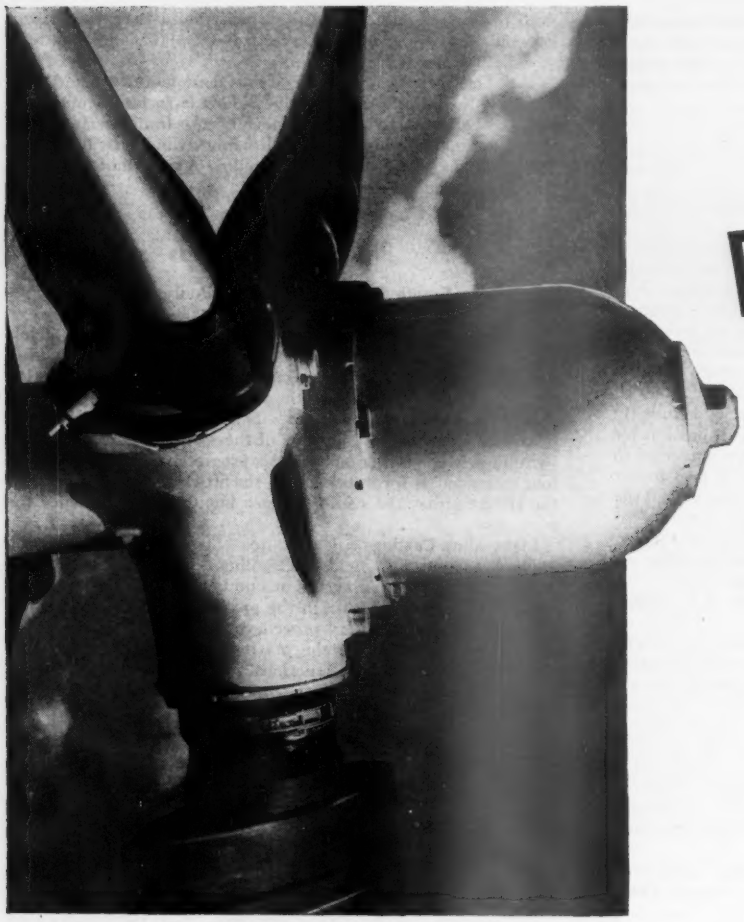
Testing Spot Welds: A New Non-Destructive Method for Stainless Steel. A. M. Armour. *Aircraft Production*, Vol. 9, No. 104, June, 1947, pp. 233–235, illus.

The Metroflux captive-fluid magnetic detector cell, developed by the Metropolitan-Vickers Research Department, consists of a transparent plastic molding in the form of a shallow dish with a thin diaphragm forming a back that is usually white and opaque. The cell contains a small quantity of black magnetic fluid made up of minute magnetic particles suspended in a light oil. If the detector is placed on a magnetized sheet face containing a spot weld, the magnetic particles will reveal the spot weld as a black particle pattern on the white diaphragm. This will occur only if the magnetic properties of the spot differ appreciably from those of the parent sheet. The detector, therefore, shows only those spots that have reached a high enough temperature during welding to produce satisfactory welds. Most ferrous stainless alloys can be tested by this method.

Spotweld Analyzer for Maintenance Work. D. F. Hays. *The Iron Age*, Vol. 159, No. 24, June 12, 1947, pp. 49–51, illus.

A compact test instrument provides instantaneous and continuous indication or recording of the tip-force and welding current variations with time. Electrodes equipped with strain gages can be installed in the machine to be tested, the strain-gage bridge balanced, the sweep tip leads connected, and all preparatory adjustments can be accomplished in approximately 5 min.

Production of Hydraulic Equipment. II—Fixtures Used in Machining Thin-Walled and Other Work: Highly Accurate Surface-Finishing of Small Components. *Aircraft Production*,



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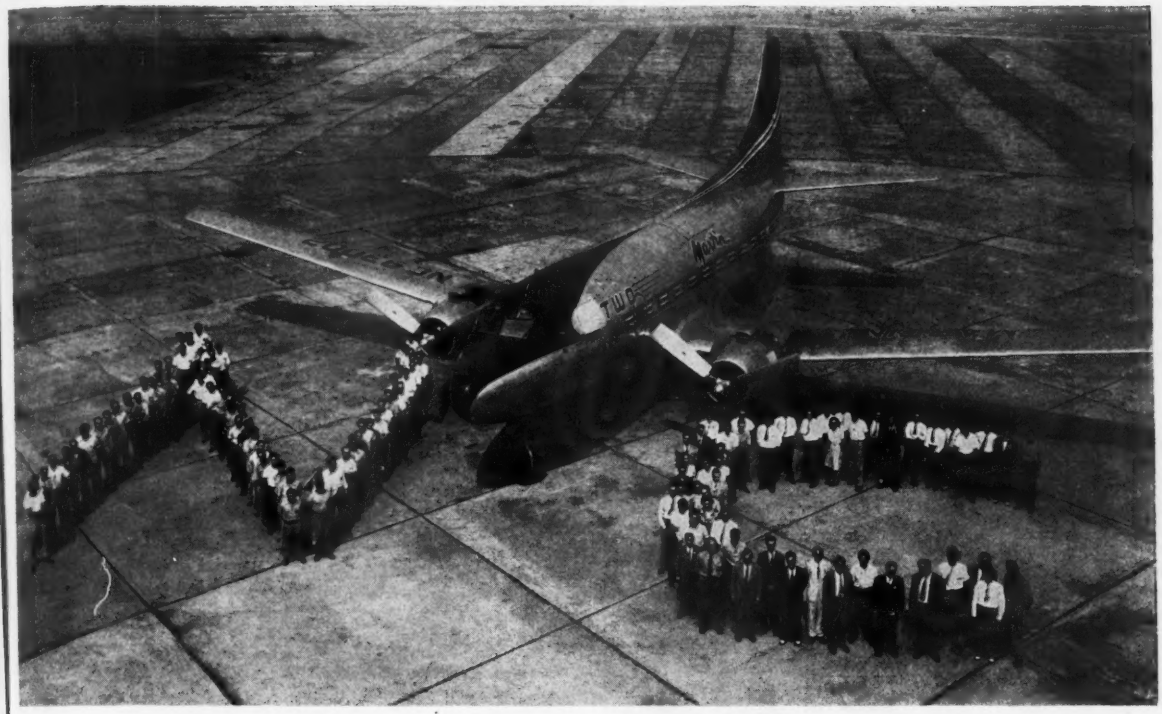

Martin 2-0-2 receives type certificate after rigorous 8-month test program.

Vol. 9, No. 104, June, 1947, pp. 226–231, illus. (Cf. AER 8/47: 57.)

Science Meets Production; How Scientific Know-How Solves Some of the Knotty Production Problems. Gilbert C. Close. *Air Trails and Science Frontiers*, Vol. 28, No. 4, July, 1947, pp. 24–26, 73–76, illus.

Production Tools and Equipment

Tube-Bending Tool and a Hand Tool for the Determination of Length of Rivets for Various Types of Rivet Heads. (*Junkers Flugzeug und Motorenwerke, Ju/T/41*, June, 1942.) *U.S., Army Air Forces, Translation No. F-TS-1915-RE*, May, 1947. 3 pp., illus.

Propellers

The Application of the Calculus of Variations to Propeller Design with Particular Reference to Spitfire VII with Merlin 61 Engine. A. B. Haines and K. V. Diprose. *Gt. Brit., Aeronautical Research Council, Reports and Memoranda No. 2083*, May, 1943. 31 pp., figs.

The calculus of variations method can give useful indications of the best type of plan form and pitch distribution for optimum performance under any given set of conditions. Applying the method to the example chosen results in highly twisted blades having their maximum width fairly far out and with rather pointed tips. Designing the blade shape to improve the efficiency at top speed results in an improvement of 2 to 3 per cent over the range from top speed to climb conditions.

NACA Five-Blade Quiet Prop Forecasts Noise Nuisance End. Alexander McSurely. *Aviation News*, Vol. 7, No. 23, June 9, 1947, pp. 16–17, illus.

Experimental design has a diameter of 98 in. and a blade chord of 14 1/2 in. Each blade is pitched 30° at 3/4 station. When mounted on a Stinson L-5 the noise level is approximately 63 db. when cruising at 110 m.p.h. at an altitude of 300 ft. The engine muffler is cooled by airflow from a scoop under the fuselage. Reduction gearing operated the propeller at 1,000 r.p.m. during the tests.

Overhaul of the Hamilton Propeller. S. D. McCormick. *Airports*, Vol. 11, No. 6, June, 1947, pp. 37, 38, illus. Directions for disassembling, cleaning, inspecting, adjusting, and reassembling the hydromatic propeller.

Hydromatic Propeller Test Machine. *Greer Hydraulics, Inc., Release*, Recd. June 24, 1947. 1 p., illus.

The GT-185 test machine consists of a test table and a completely self-contained, portable power unit. It has been developed for simple operation and provides ample power to handle the latest type of propeller domes. The shutoff valves are solenoid-operated, and positive action controls prevent lost motion.

Radio and Electronics

4-Band Automatic Radio Direction Finder for Transport Planes. Richard H. Bailey. *Radio News*, Vol. 37, No. 6, June, 1947, pp. 68, 69, 128–130, illus.

The four-band radio direction compass AN/ARN-6, developed by the Fairchild Camera and Instrument Corporation at Wright Field for the Army Air Forces, is now available on the commercial market. The entire unit weighs 60 lbs., covers a range of 100 to 1,750 kc., and affords combined visual and aural indication. A thyraton loop control automatically turns the compass loop to face the station being received and indicates direction with an accuracy of 1°.

Timer for Radar Echoes. L. A. Meacham. *Bell Laboratories Record*, Vol. 25, No. 6, June, 1947, pp. 231–236, illus.

Description and circuit diagrams of an asynchronous radar range unit. The method, which was used previously at lower speeds for measuring telegraphic distortions, employs an oscillator that can be started and stopped suddenly enough to allow the independent time measurements to be made on terms of cycles and fractions of cycles of the resulting trains of oscillations.

Radar Eyes for the Black Widow. J. B. Maggio. *Bell Laboratories Record*, Vol. 25, No. 6, June, 1947, pp. 221–226, illus.

The AN/APG-1 radar was installed on the Northrop P-61 night fighter to fulfill the functions of searching the area ahead of the interceptor for targets and of automatically tracking a specific target in range and direction. Operation of the equipment is described in detail.

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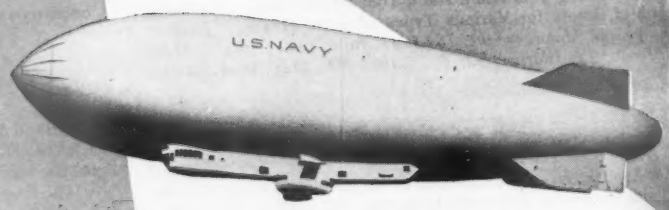

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RCA Develops Aircraft Antenna Completely Eliminating Drag. *Radio Corporation of America, RCA Victor Div., Release*, Recd. June 24, 1947. 1 p.

The RCA Type MI-19727 slot antenna, which consists of an aluminum cavity-resonating-device installed in the wing or fuselage, replaces the protruding half-wave dipole antenna. The exposed face is covered by Plexiglas to retain the streamlines of the aircraft surface. The antenna produces the radiation pattern required for aircraft radar altimeters and is suitable for transmission and reception in the 420- to 460-mc. band.

A Broad-Band Antenna of Changeable Radiation Pattern for Centimeter Waves. Otmar Stuetzer. (*EIS/Graef/266*, July, 1941.) *U.S., Army Air Forces, Translation No. F-TS-1120-RE*, May, 1947. 8 pp., illus. Design notes on an antenna with uniform output impedance over a broad band and an adjustable radiation pattern.

Miniature Antennas—A New Tool for the Antenna Designer. George Sinclair. *Radio News*, Vol. 37, No. 6, June, 1947, Engineering Dept., pp. 17, 18, 31, illus. 1 reference. (Cf. AER 3/47:81.)

Report on Swiss Radio-Frequency Signal Generator, Model 601. Roy L. James. (Project No. EE-54, Analysis Made by General Radio Co.) *U.S., Army Air Forces, Technical Report No. F-TR-1144-ND*, May, 1947. 13 pp., illus.

The equipment was used by the Germans as a standard signal generator The generator has eleven bands covering a range of 9.5 kc. to 31 mc. The equipment is unduly massive. Performance is in most respects inferior to that of equipment currently produced in the United States. Only with respect to the frequency calibration of the main dial and the low-frequency-drift characteristic, which is particularly noticeable in the range 43–96 kc., is it above average. The coil for this range is a ceramic form with metal deposited in a spiral groove to form the winding.

Activated Phosphors. I—The Activation of Phosphors to Infra-Red. B. Tomaschek and P. Brauer. (*ZWB/FB/Nr. 1695/1*, April 17, 1943.) *Gt. Brit., Ministry of Supply, RTP/TIB Translation No. GDC/10/348T*. 12 pp. 30 references.

Rotating Wing Aircraft

The Performance of Rotating Wing Aircraft. C. F. Toms. *Aircraft Engineering*, Vol. 19, No. 219, May, 1947, pp. 150–158, 162, diagrs.

An analysis of the problems involved in rotating wing aircraft rotors based on simple "strip" theory, disregarding the effects of periodic flow conditions on airfoil section force coefficients and using a system of force and torque coefficients and parameters similar to those employed in the case of propellers. In its general form the analysis can be applied graphically to rotors having an arbitrary blade plan form and an arbitrary blade twist. The analysis is applied to two particular blade plan forms with zero twist and to one of these plan forms with a particular twist. The resulting charts are simple to use. It is assumed that rotor blades do not twist or bend under load. Both the autorotational and the propulsive types of operation are considered. The results of the analysis for autorotation agree well with available experimental data. The results obtained for power rotation should be equally reliable despite the lack of suitable data.

Airfoil in Sinusoidal Motion in a Pulsating Stream. J. Mayo Greenberg. *U.S., N.A.C.A., Technical Note No. 1326*, June, 1947. 20 pp., figs. 3 references.

The forces and moments on a two-dimensional airfoil in harmonic motion in a pulsating stream are derived using the theory of nonstationary incompressible potential flow and including the effect of the continuous sheet of vortices shed from the trailing edge. The form of the wake is assumed to be sinusoidal. A numerical example for the approximation of the wake shows excellent agreement with previous work done on the special case of a stationary airfoil. The results obtained are expected to be useful in the study of forced vibrations and flutter of rotary-wing aircraft, the lifting surfaces of which are in air streams of variable velocity.

Practical Engineering of Rotary Wing Aircraft. X. Harris S. Campbell. *Aviation*, Vol. 46, No. 6, June, 1947, pp. 54–57, figs. (Cf. AER 6/47:53.)

Detail drawings of various designs used for attaching rotor blades to the hub. These unions must permit pitching of the individual blades and coning of the entire rotor. Calculations are worked out to determine the strength required in the drag pivot pin, the extension link at the drag pin, and the flapping pivot and lugs.

Helicopter Control Systems. George D. Ray. *Machine Design*, Vol. 19, No. 6, June, 1947, pp. 101–106, illus.

The design of the cyclic-pitch and tail-rotor control system of the Bell 47 helicopter. Control procedure, control elements, feed back, irreversible controls, and throttle control are described in detail.

Development Problems of the H-100. Arthur C. Schouw. *American Helicopter*, Vol. 7, No. 7, June, 1947, pp. 20, 21, 36–38, figs.

An account of the development of a wind tunnel to test helicopter rotors, and a discussion of the problems met in developing the H-100. A system of automatically compensating air scoops was devised to provide a constant flow of coolant air over the motor at all times. Moisture effects in wood rotor blades were found to disturb blade balance. This led to the adoption of metal blades.

The Helicopter and Jet Propulsion. E. S. Franklin. *American Helicopter*, Vol. 7, No. 7, June, 1947, pp. 22, 35, figs.

The Helicospeeder designed by Antoine Gazda employs a main thrust along the longitudinal axis and opposing jets to compensate for the torque of the rotating airfoil. Anthony Sbrilli proposes a jet as the prime mover of the rotor and jets of compressed air expelled from jet tubes coaxial with the rotor. F. A. Howard in his patent describes a system in which a compressor in the fuselage supplies through conduits a combustible mixture to a combustion chamber at the tip of the rotating wing. A. E. Larsen has proposed a rotor driven by small jet-driven propellers mounted at the tips of the rotor blades.

Flettner-282. M. Berry. *American Helicopter*, Vol. 7, No. 7, June, 1947, pp. 18, 19, 33, 34, diagr.

Design details of the Flettner 282. This is a one- or two-place aircraft employing two intermeshing two-blade rotors, driven by a Siemens Halske 4A seven-cylinder air-cooled engine. The eight-blade 26.8-inch wooden engine-cooling fan is mounted on an extension of the drive shaft. Air enters at the bottom of the fuselage, passes through the fan to the engine, and passes down and out through another opening in the bottom of the fuselage. No means of controlling the airflow is provided. Normal engine temperature is 225°C. Longitudinal and lateral control is accomplished by joint cyclic-pitch change of the two rotors—i.e., by tilting both gimbal rings in the same direction.

Notes from Helicopter School. I. Wolfgang Langewiesche. *Air Facts*, Vol. 10, No. 6, June 1, 1947, pp. 62–79, illus. A popular description of the technique of operating a helicopter.

Limitations in Helicopter Design. II. J. A. J. Bennett. *American Helicopter*, Vol. 7, No. 7, June, 1947, pp. 10, 11, 30–35, figs. (Cf. AER 7/47:65.)

Seaplanes and Flying Boats

Aerodynamic Characteristics of Three Planing-Tail Flying-Boat Hulls. Campbell C. Yates and John M. Riebe. *U.S., N.A.C.A., Technical Note No. 1306*, June, 1947. 21 pp., illus. 6 references.

An investigation was made to determine the aerodynamic characteristics of three planing-tail flying-boat hulls that differed only in the amount of step fairing. The hulls were derived by altering the step and afterbody of a conventional flying-boat hull having a transverse step. The planing-tail hull with a large pointed step had about the same minimum drag coefficient, 0.0065, as the conventional hull of the same overall length-beam ratio. The hulls with step fairing had up to 18 per cent less minimum drag coefficient than either the conventional hull or planing-tail hull with a large pointed step. The angle of attack for minimum drag was generally between 3° and 5°. Longitudinal instability and lateral instability were similar for all planing-tail hulls tested and were about the same as for the conventional hull.

Hydrodynamic Impact Loads in Smooth Water for a Prismatic Float Having an Angle of Dead Rise of 30°. Robert W. Miller and Samuel Leshnover. *U.S., N.A.C.A., Technical Note No. 1325*, June, 1947. 14 pp., diagrs. 5 references.

In order to secure a compromise between the good planing characteristics of a flat bottom and the impact-reducing properties of a V-bottom, an analysis was made of experimental data for fixed trim impacts in smooth water of a prismatic-float forebody having an angle of dead rise of 30° at a trim 6° and 15°, and of a similar float of 22 1/2° angle of dead rise at 6° trim. In this analy-

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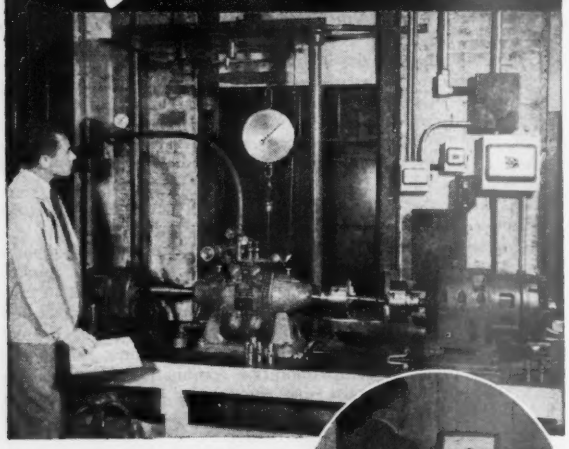

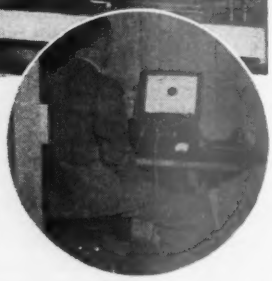

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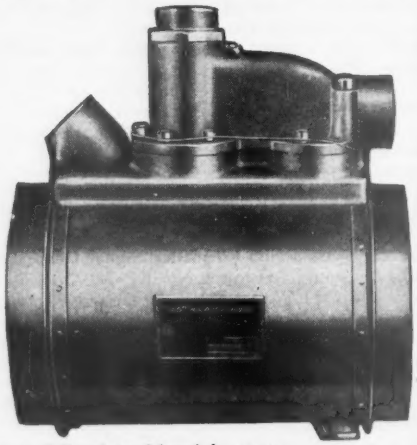

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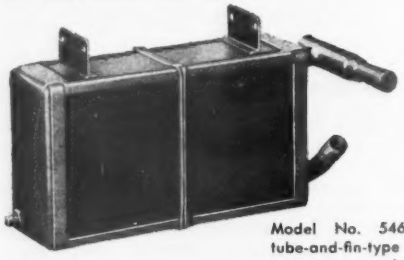

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sis the effects of chine immersion and afterbody were small. The loads encountered during impact can be predicted by the curves and equations presented in this paper. For each trim a single curve may be used to represent the maximum loads for a wide range of impact conditions. The variation of hydrodynamic impact load with the dead-rise angle may be represented, for the range of dead-angle rise considered, by a function that agrees with the experimental data within about 6 per cent. An increase in dead-rise angle according to this formula results in a considerable decrease in the loads encountered.

Recent Developments in Flying Boats. I, II. Henry Knowler. *Engineering*, Vol. 163, Nos. 4243, 4244, May 23, May 30, 1947, pp. 441–444, figs.; pp. 463, 464, diagrs. (Cf. AER 4/47:67.)

Stress Analysis and Structures

Pure Bending in the Plastic Range. Harry A. Williams. *Journal of the Aeronautical Sciences*, Vol. 14, No. 8, August, 1947, pp. 457–469, figs. 7 references.

The possibilities of the graphical solution of Saint-Venant's method are illustrated by using what is termed a plastic bending factor that is plotted against outer fiber stress. The ultimate resisting moment of a number of materials may be readily obtained from the curves shown. The ultimate resisting moments of beams are approximately proportional to the ultimate tensile strengths of the materials involved if the stress-strain curves are of the same general form. The investigation is restricted to pure bending.

A Tabulation Method for the Calculation of the Critical Speed of Wing Divergence. Walter P. Targoff. *Journal of the Aeronautical Sciences*, Vol. 14, No. 8, August, 1947, pp. 487, 488, table. 1 reference.

The similarity between torsional aerodydamic moment and an inertia torque is noted. Holzer's method is then modified by the substitution of aerodynamic for inertia moments. A sample divergence calculation is given.

Numerical Procedure for Calculation of Stress Distribution in Sheet-Stringer-Frame Combinations. Marvin Stern. *Journal of the Aeronautical Sciences*, Vol. 14, No. 8, August, 1947, pp. 481–486, figs. 3 references. (*See* AER 4/47:29.)

Index of Aircraft Structures Research Reports. *U.S., N.A.C.A., Index No. 7E29*, June, 1947. 40 pp.

A subject index to all papers published by the N.A.C.A. on structures research. In addition to "Reports," "Technical Notes," and "Technical Memorandums," the 460-odd titles listed include "Advance Restricted Reports," "Advance Confidential Reports," "Memorandum Reports," and other wartime series. Where reports in the wartime series have been reissued as "Wartime Reports," the "Wartime Report" number is also given. Some of the papers are grouped by the type of structure, such as plates, shells, and linear structures. Others are grouped under the problem treated or the procedures investigated, such as aerostructural problems, dynamic loads, and testing procedures. Each major group is divided into more specific subsections; within each subsection the titles are arranged chronologically by date of publication. There is also a list of papers on materials research; this is not intended to be a complete list of published work but rather a list of some papers that are considered to overlap the field of structures research. An attempt has been made to indicate those papers that are out of print.

Critical Combinations of Torsion and Direct Axial Stress for Thin-Walled Cylinders. S. S. Batdorf, Manuel Stein, and Murry Schildcrout. *U.S., N.A.C.A., Technical Note No. 1345*, June, 1947. 36 pp., figs. 100 references.

Theoretical interaction curves are derived for the combination of direct axial stress and torsion which causes thin-walled cylinder to buckle. From test data, empirical interaction curves and formulas are developed which are rational modifications of the theory. These results can be used over a much wider range of cylinder dimensions than was possible with the results heretofore available.

A Simplified Method of Elastic-Stability Analysis for Thin Cylindrical Shells. I—Donnell's Equation. S. B. Batdorf. *U.S., N.A.C.A. Technical Note No. 1341*, June, 1947. 49 pp., illus. 20 references.

When Donnell's equation for the equilibrium of cylindrical shells is used to find the buckling stresses of cylindrical shells, simpler results are obtained less laboriously than when equations are used in which the second order terms are retained. Except for axial loading, the buckling stresses found by the use of Donnell's equation are in reasonable agreement with results based on other theoretical calculations and with test results. Boundary conditions having to do with axial and circumferential displacements cannot be handled directly by use of this equation. This disadvantage is not serious, because the boundary conditions on axial and circumferential displacement, which are implied by the simple solution given, correspond approximately to those that are most likely to occur in practical construction and because in many cases the buckling stress is not very sensitive to these boundary conditions.

Critical Stress of Thin-Walled Cylinders in Torsion. S. B. Batdorf, Manuel Stein, and Murry Schildcrout. *U.S., N.A.C.A., Technical Note No. 1344*, June, 1947. 26 pp., figs. 9 references.

A theoretical solution for the critical stress of thin-walled cylinders loaded in torsion. The results were obtained by a method of analysis considerably simpler than, but essentially equivalent to, that used by Donnell. The results are given by a few simple formulas and curves applicable to a wide range of cylinder dimensions from short cylinders of large radius to long cylinders of small radius. These theoretical results are found to be in somewhat better agreement with experimental results than previous theoretical work for the same range of cylinder dimensions.

Charts for Stress Analysis of Reinforced Circular Cylinders Under Lateral Loads. Joseph Kempner and John E. Duberg. *U.S., N.A.C.A., Technical Note No. 1310*, May, 1947. 58 pp., diagrs. 5 references. (Cf. AER 5/47:57.)

The charts facilitate the rapid determination of the shear flows and direct stresses in the sheet of the cylinder, as well as the shear forces, axial forces, and bending moments in the rings. Separate charts are given for a concentrated tangential load and a concentrated bending moment. They apply to a cylinder of uniform construction loaded in the plane of one reinforcing ring and are based on the solution of the finite-difference equation developed in *N.A.C.A. Technical Note No. 1219*, which includes the effects of deformations of rings and sheet. The coefficients can be obtained by computing values of two simple structural parameters and referring to the curves given in the charts. The stresses due to loads applied at several rings or at different positions of the same ring can be superimposed to give the stresses caused by these loads acting simultaneously.

Critical Combinations of Shear and Longitudinal Direct Stress for Long Plates with Transverse Curvature. S. B. Batdorf, Murry Shildcrout, and Manuel Stein. *U.S., N.A.C.A., Technical Note No. 1347*, June, 1947. 36 pp., figs. 15 references.

Theoretical curves are unsuitable for use in design in the compression range because long plates with substantial curvature loaded in axial compression buckle at stresses that are much less than the theoretical critical stress values. An investigation was made to determine the modifications required to make the theoretical curves compatible with the available experimental data. A theoretical solution is presented for the buckling stresses of long plates with transverse curvature loaded in shear and longitudinal direct stress. The theoretical critical-stress combinations for plates having either simply supported or clamped edges are given in figures and tables. Interaction curves based upon this investigation are recommended provisionally for use in design. Since both the theoretical and the design curves suggested are essentially parabolas, it is possible for simple approximate interaction formulas to be given.

The Local Buckling Strength of Lipped Z-Columns with Small Lip Width. Pai C. Hu and James C. McCulloch. *U.S., N.A.C.A., Technical Note No. 1335*, June, 1947. 15 pp., diagrs. 12 references.

Dynamic Stress Calculations for Two Airplanes in Various Gusts. Harold B. Pierce. *U.S., N.A.C.A., Advance Restricted Report Wartime Report No. L-484)*, September, 1941. 21 pp., diagrs. 3 references.

Requirements for Dynamic Test Equipment in Certain Aircraft Applications. Lee S. Wasserman. *Instruments*, Vol. 20, No. 5, May, 1947, pp. 444–447, figs.

An outline of the development and procurement of dynamic test equipment for the Flutter Unit, Dynamics Branch of the Air Matériel Command. The requirements of the equipment are indicated by a discussion of the limitations of the equipment used. Two types of phenomena came into question, flutter oscillations and impact loads. The velocity pickups originally available were not sufficiently sensitive in the lower part of the fre-

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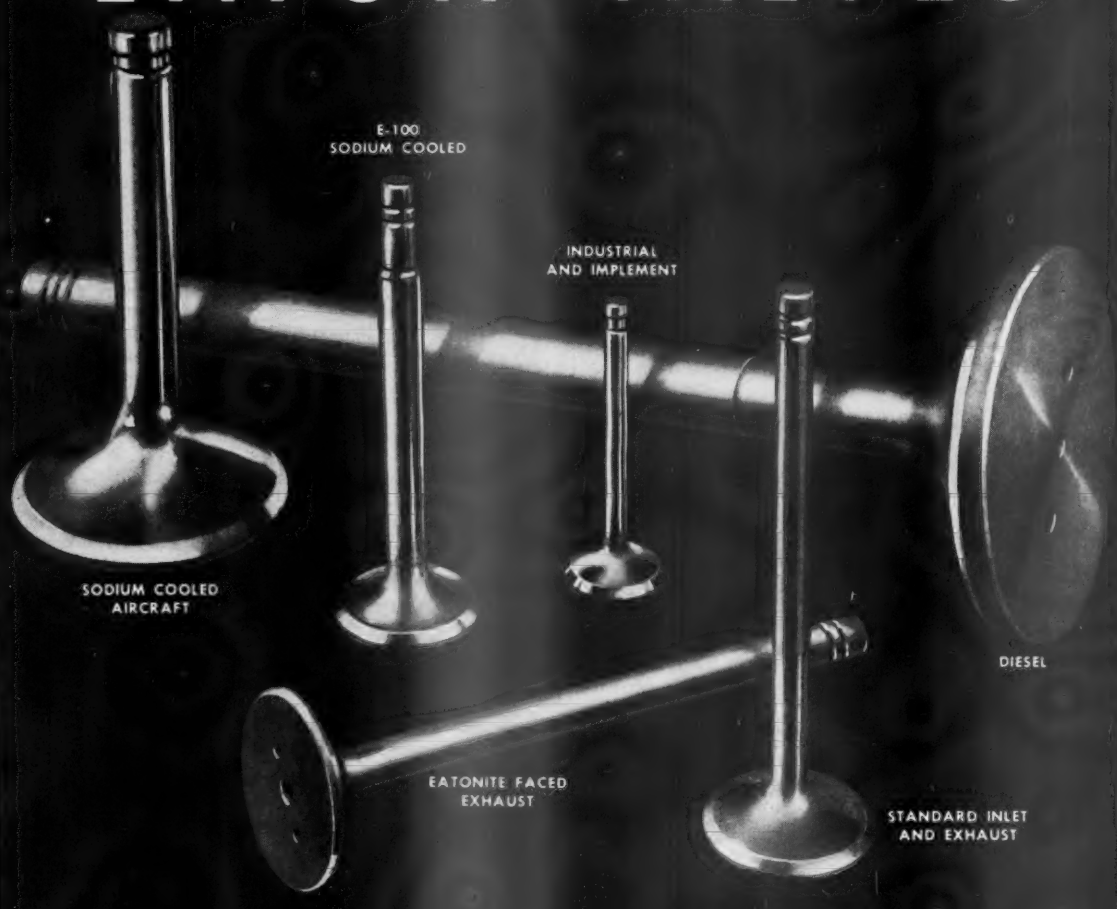

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quency range of flutter oscillations. A cantilever-beam-type fluid-damped strain-gage accelerometer was developed. Unsatisfactory characteristics of the original design led to the use of carrier equipment with reluctance-type magnetically damped galvanometers and circuits for single and double integration of the accelerometer output to give vibration velocity and displacement, respectively. A 34-channel oscillograph was used to overcome the difficulty of synchronizing a number of oscillographs. Further refinement led to a reduction in weight and size of the equipment.

Structural Testing for Transonic Flight. Gilbert C. Close. *Western Flight*, Vol. 27, No. 6, June, 1947, pp. 16–18, 26, illus.

A description of the extensive tests to which the Douglas Skystreak is being subjected to ensure an aircraft that will withstand all the stresses anticipated at transonic speeds and which will provide a substantial safety margin if these estimates are inadequate.

Mechanical Testing. I—Laboratory Organization and Equipment. *Aircraft Production*, Vol. 9, No. 104, June, 1947, pp. 209–212, illus.

Recommendations for organizing a materials testing laboratory and for selecting equipment. Suggestions are made for proper layout of the laboratory and for the selection of personnel. Among the equipment described, which is used at Bristol Aeroplane Co. and the Royal Aircraft Establishment, Farnsborough, is a bending and torsion testing machine of 500 tons per ft. bending moment and 550 tons per ft. torsional capacity, and a windscreen-panel-static-pressure-test rig. A windshield testing machine is mentioned which consists of a motor-driven rotor arm of 4-ft. radius carrying a release mechanism at the tip. Missiles, including dead birds, are held in a wide-mesh nylon net that is attachable to the release gear and can be released at a predetermined position by remote control.

Photoelastic Stress-Analysis. *Aircraft Production*, Vol. 9, No. 104, June, 1947, p. 232, illus.

David Brown and Sons, Ltd., has applied this method of analysis to gears and small parts. The transparent model, which is subjected to stress, is carried in a frame on an adjustable table between condensing lenses with a 12-in. focal length. The polarizer and the analyzer each consist of a sheet of polaroid 6 in. in diameter and a mica quarter-wave plate mounted in a circular holder. Investigation of the stresses in gear rims showed that the thickness of a rim may be reduced to a value equal to 0.6 of the circular pitch of the gear without appreciably reducing the breaking strength of the rim. The practice of securing a gear rim to a center by means of grub screws does not appreciably reduce the strength of the rim, provided the size of the screws is kept below a certain limit.

Wind Tunnels and Laboratories

A Method of Wind-Tunnel Testing Through the Transonic Range. John H. Weaver. *Lockheed Aircraft Corp.* (For abstract see "I.A.S. Briefs" on page 29 of this issue, September, 1947.)

High-Speed Testing in the Southern California Cooperative Wind Tunnel. Clark B. Millikan, J. E. Smith, and R. J. Bell. *California Institute of Technology.* (For abstract see "I.A.S. Briefs" on page 28 of this issue, September, 1947.)

Notes on the Deflection of Jets by Insertion of Curved Surfaces, and on the Design of Bends in Wind Tunnels. M. J. Lighthill. *Gt. Brit., Aeronautical Research Council, Reports and Memoranda No. 2105*, September, 1945. 5 pp., figs. 1 reference.

Small jets of water can be deflected by the partial insertion of a curved surface into the jet. The surface experiences a force impelling it toward the center of the jet, but if this force is withstood by an equal and opposite force, the fluid is drawn around the surface and comes off at an angle. Examples of this effect are derived mathematically by building up various plane flows (in the Helmholtz-Kirchhoff manner) by assuming patterns in the hodograph plane. If wind-tunnel bends are designed according to this pattern (with the walls replacing the sides of the jet), the velocity will be constant along the walls except in a small limited region where deleterious effects of adverse velocity gradient can be checked by moving the walls or by suction slots. A 180° bend, with all adverse gradient avoided by the use of one suction slot, is designed. This practice would eliminate the need for cascades in wind tunnels and would reduce the number of bends from four to two.

The Langley Two-Dimensional Low-Turbulence Pressure Tunnel. Albert E. von Doenhoff and Frank T. Abbott, Jr. *U.S., N.A.C.A. Technical Note No. 1283*, May, 1947. 69 pp., illus. 15 references.

Information and experience obtained from work on the Langley two-dimensional low-turbulence tunnel proved invaluable in the design and operation of the Langley two-dimensional low-turbulence pressure tunnel. The final design was of the single-return closed-throat type. The test section is rectangular, 3 ft. wide, $7\frac{1}{2}$ ft. high, and $7\frac{1}{2}$ ft. long. The air stream enters the test section through a relatively short entrance cone from a large square section giving a contraction ratio of 17.6 to 1. The overall size of the wind-tunnel shell is about 146 ft. long and 58 ft. wide with a maximum diameter of 36 ft. The air pressure may be varied from approximately full vacuum to 10 atmospheres absolute. Compressing the air in this tunnel to increase its density and mounting models so that the test section is completely spanned make it possible to obtain full-scale Reynolds Numbers with moderate power. Since the airflow acts only in two dimensions and cross flows around the ends of the span are prevented, a much larger ratio of model size to tunnel cross section is permitted. The large area reduction between the entrance cone and the test section makes the turbulence low. Lift is evaluated from measurements of the pressure reactions of the floor and ceiling of the tunnel. The drag value is obtained from measurements of static and total pressures in the wake of the airfoil. Moments are usually measured by a balance. These methods of measuring the forces on the model have the advantage that the data can easily be reduced and that forces acting on the model supports are eliminated.

Something New in Supersonic Wind Tunnels. *U.S. Air Services*, Vol. 32, No. 6, June, 1947, p. 29, illus. (Cf. AER 7/47: 77.)

The Aerophysics Laboratory of North American Aviation, Inc., is using a small continuous-flow supersonic wind tunnel for research on supersonic guided missiles. Mach Numbers from 1.25 to 3.25 can be reached in the test section, which measures 1.75 by 4.5 in. An adjustable diffuser in the exhaust section allows the highest possible air speed for the pressure being used. It is estimated that the tunnel will be from 10 to 15 per cent more efficient than tunnels with fixed diffusers.

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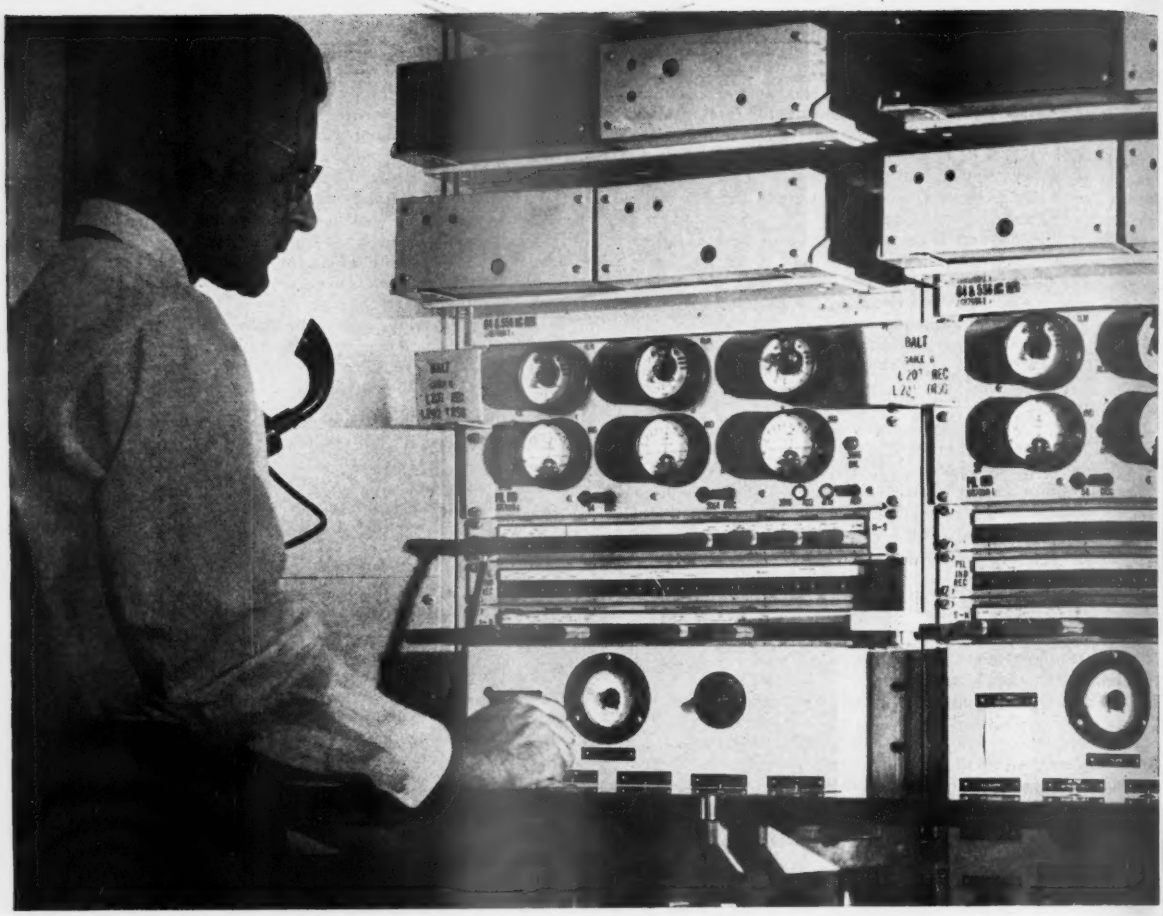

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Books

All of the books reviewed and listed are in the I.A.S. Library and may be borrowed without charge, except for certain reference books. Application for loans should be made to The Paul Kollsman Lending Library, 2 East 64th Street, New York 21, N.Y.

Aircraft Materials and Processes. George F. Titterton. 3rd Ed. New York, Pitman Publishing Corporation, 1947. 537 pp., illus., tables. $4.75.

While *Aircraft Materials and Processes* is already well known to aviation engineers, students, and shop men, some comments regarding this third edition are in order: first, because the original volume and its second edition have proved of real value to those requiring coordinated information on the materials and processes used in the construction of aircraft; and, second, because in the present offering the author has included many of the new materials and processes for aircraft applications developed during the late war. In order to keep the revised edition up to date for as long a time as possible, he has even included basic data on materials that have not yet been fully accepted but show promise. When the first revised edition was issued at the time of the national emergency, the author expressed the hope that it would prove useful in training new personnel entering the rapidly expanding aircraft industry. It is believed this hope has been fully realized.

The book is general in scope and is based on a series of lectures given by the author at New York University. It is printed on paper of good quality and contains excellent illustrations and drawings. The data have been collected from many sources. In the first chapter physical terms, heat-treatment terms, and physical-test terms are defined. Some of the subjects then discussed include the testing of aircraft materials; the properties and use of aircraft steels; the heat-treatment and surface hardening of steel; the shaping of metal; corrosion-resisting steels; nickel, copper, and wrought aluminum alloys; aluminum-alloy castings; magnesium alloys; metal-joining processes; corrosion and its prevention; wood and glue; fabrics, plastics, and rubber; and the selection of materials. Appendixes contain extensive reference data for the aircraft engineer.

Gas Dynamics Tables for Air. Howard W. Emmons. New York, Dover Publications, Inc., 1947. 46 pp. $1.75.

The data presented in four tables are isentropic gas dynamics functions for air, gas dynamics functions for normal shocks, a characteristics table, and an acoustic velocity-temperature table. These are followed by 19 curves presenting the tabulated functions graphically. They include pressure ratio, velocity ratio, dynamic pressure, area ratio, density ratio, mass velocity, temperature ratio, acoustic velocity ratio, Mach angle and property angle vs. Mach Number, and various relationships to Mach Number before shock and upstream of the normal shock. Computation formulas are given in the introduction. The tables were in part produced for use in research at Harvard University sponsored by Pratt & Whitney Aircraft.

Thermodynamique des Systèmes Propulsifs à Réaction et de la Turbine à Gaz (Thermodynamics of Reaction Propulsion Systems and of Gas Turbines). Maurice Roy. Paris, Dunod, 1947. 160 pp., diagrs. 540 fr.

Professor Roy brings together here the substance of lectures given at the compressible fluids section of the Center for Advanced Study in Mechanics in Paris in 1946. A systematic procedure is presented as a working tool for the application of thermodynamics to internal-combustion reaction-propulsion systems and to gas turbines. About half of this book is devoted to two chapters on the thermodynamics of combustion chambers, nozzles, blades, and stages of turbines and compressors, and to various types of jet engines, including subsonic and supersonic aeroducts or ram-jets, and engine- or turbine-jet combinations. A coherent system of definitions and introductory formulas are given in the general first chapter. There are shorter chapters on rockets, turbine propeller systems, and gas turbines. Cross references are made freely to various parts of the methods presented, and numerical examples are included. Footnote references are made to the literature. The author brings more than 20 years of research to the writing of this book, and it can be recommended as a useful addition to the literature of reaction propulsion.

Aircraft Strength of Materials. H. D. Conway. London, Chapman and Hall, Ltd., 1947. 256 pp., figs., tables. 21*s*.

Aircraft engineers are constantly faced with problems connected with the strength of materials and structures, but the number of books specifically devoted to this subject have been limited. Because of this condition, *Aircraft Strength of Materials* should be welcomed by all those whose work is concerned with the design of aircraft. The volume has been written especially to meet the requirements of the aircraft engineer but should prove of service to others, such as draftsmen and stress office staffs, since the mathematics included is not too advanced. For obvious reasons, no attempt has been made to avoid the use of differential and integral calculus, but the mathematics is not above the standard required in senior technical schools. The author notes that in preparing the work he has drawn on such well-established treatises as Morley's *Strength of Materials* and Case's *Strength of Materials*. The sources of original work are given whenever possible.

The first six chapters are devoted to principles of stress and strain, stress analysis of beams, torsion, deflection of beams, and struts and ties. Other chapters deal with simply-stiff structures, redundant structures, and thin-plate construction. Included in appendixes are the methods of calculating the stresses in closed rings and a table of Berry functions.

The Elements of Aircraft Propeller Design. F. T. Meacock. London, E. & F. N. Spon, Ltd., 1947. 96 pp., illus., diagrs. 12*s*. 6*d*.

The author's purpose is to present a brief introduction to propeller design in general terms and to indicate the main trends in development with their underlying reasons. The first section deals with basic aerodynamic principles and the second section with developments in propeller aerodynamic design, including fixed-pitch, two-pitch, constant-speed, feathering, high-solidity, and counterrotating propellers; propellers as brakes; and blade aerodynamic design. The final section deals with aspects of the

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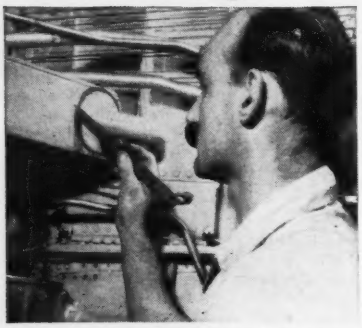

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Silastic 121 is used to seal hot airducts in thermal anti-icing system designed for the Martin 2-0-2.

Not content with the more conventional de-icing systems designed to remove ice after it has formed, engineers of the Glenn L. Martin Company developed a thermal anti-icing system for the Martin 2-0-2. This system carries hot air to the leading edges of the wings and tail to keep ice from forming even under severe icing conditions.

Preliminary estimates indicated that impossible amounts of heat would be required. Experimentation proved, however, that conventional thermal calculations do not apply to flight conditions. Combining research with flight testing, the Martin engineers perfected a system so far advanced in principle and performance that it is setting new anti-icing standards for the aviation industry.

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mechanical design of propellers, as required by the aerodynamic developments of the variable-pitch propeller. The discussion here is based primarily on de Havilland propellers, although Curtiss, Hamilton, Rotol, and other makes are mentioned. Over 80 excellent photographs and diagrams illustrating the text are presented in a separate section. The book can be recommended as a good introductory work requiring only an elementary knowledge of aerodynamics.

Recent Aeronautical Literature; A Selective Subject Index for 1946. Compiled and Edited by Willard Kelso Dennis. Wichita, Beech Aircraft Corp., 1947. 419 pp. $10.00.

The 1946 edition of *Recent Aeronautical Literature* constitutes a cumulation of the monthly issues published in 1946. More than 15,000 periodical articles have been indexed. These articles have been taken from 55 American and British periodicals on aeronautics and related subjects. Entries from other periodicals have been added where applicable. Following the plan of the monthly issues and the previous cumulations, the subject headings are arranged alphabetically, and the entries are listed by title under each heading. Selection in the matter of subjects has not been attempted, so that for the periodicals covered the index is representative of the literature published on various phases of aviation.

Recent Aeronautical Literature has been published monthly since January, 1943. Earlier cumulative volumes were issued for 1943; January–June, 1944; July–December, 1944; and 1945. The 1945 volume is still available at $5.00. The 1946 cumulative volume of *Recent Aeronautical Literature* is reproduced from typewritten copy and sells for $10. A subscription to the monthly issues for 1947 is $10. Orders to the publisher should be accompanied by remittance, since the price of the annual volume and the monthly issues does not include billing charges.

Engineering Organization and Methods. James E. Thompson. New York, McGraw-Hill Book Co., Inc., 1947. 337 pp., illus., diagrs. $4.00.

Based on the experience of a consulting industrial engineer who was formerly Chief Engineer of the Booth Manufacturing Corporation and who is now Administrative Engineer of the Ryan Aeronautical Company, this book sets forth the fundamental principles of engineering organization in considerable detail. The volume represents a commendable effort to present the many phases of this involved subject in a clear and orderly manner. The principles have been presented as nearly in the order of their application as possible, so that the engineering executive or supervisor can develop such detailed methods as are best suited to his particular problem. Some problems are treated in a general way with

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emphasis on principles and objectives. Where a detailed method is given, it constitutes the author's choice, based on a study of the methods used by many organizations and considered representative of the best current usage. The forms required for detailed methods are fully described with examples of the proper usage of each.

The book should be a valuable aid to those who are striving to perfect the management of the engineering department and thus facilitate production and reduce engineering costs. Opening chapters discuss organization and the establishment of the functional pattern; operation and the application of the engineering program; the personnel; cost control; and planning. Some of the other subjects dealt with include standards; drawing numbering systems, drawing forms, and drawing control; advance engineering information; technical and general services; and the fundamentals of engineering management. Appendixes are devoted to typical engineering cost and time charges and typical cost-analysis investigations.

Calcul et Construction des Avions Legers (Calculation and Construction of Light Airplanes). G.-G. Desgrandschamps. 2nd Ed. Paris, F.-Louis Vivien, 1947. 153 pp., diagrs. 350 fr.

The aim of the author is to present calculation methods for the design and construction of a light airplane for the amateur who wishes to fly. It is made clear that the making of an airplane is not an easy task, but the thoroughness of the exposition is a help in that direction. The first section deals with aerodynamics, taking up thrust and drag, power, efficiency, weight, and wing surface. The procedure for a preliminary draft, balance calculations, selection of a wing profile, parasite drag and performance calculations, verification of flight qualities, and testing of the model conclude this section, which covers tables showing wing and power loading, dimensions and moments for the control surfaces, and other data for various light airplanes. The second section deals with stresses on various types of air frame, wings, movable surfaces, tail fins, controls, landing-gear fuselage, and engine mounting. The relation of materials to weight and methods of calculation for strength of various materials are taken up in the final section, which concludes with details of construction. The illustrative drawings and diagrams are clear, and numerical examples are given throughout.

Praktische Physik (Practical Physics). Friederich Kohlrausch. 18th Ed. Edited by F. Henning. (Leipzig, B. F. Tübner, 1943). New York, Mary S. Rosenberg, 1947. 2 Vols. 535, 578 pp., diagrs., tables. $13.50. (In German.)

Kohlrausch reaches its 18th edition with the appearance of these two volumes. The editor states that the point of view of the 17th edition has not been changed. The book is designed to give experimental methods of measuring the various quantities of physics. Experimental results are not given in the body of the text but are included in 60 pages of tables at the end. This edition includes six new pages of tables, and about 155 pages of new material.

The principal revisions in the section on Mechanics and Acoustics are the expansion of material on Young's Modulus and Shear Modulus, and Rigidity and Hardness, by E. Justi, into separate chapters, together with a new chaper on Compressibility of Solids and Fluids, by H. Ebert. These were formerly grouped under Mechanics of Deformable Bodies. Other subjects expanded in this section into separate chapters are Viscosity, by S. Erk; Surface Tension, by H. Moser; and Acoustics, by M. Grützmacher. In the section on Thermal Quantities and Heat a new chapter on the Production, Measurement and Application of Very Low Temperatures, by K. Steiner, has been added. A new chapter on the Spectroscopy of Atoms and Molecules, by R. Ritschel, has been added to the section on Optics. In the second volume, the chapter on Capacitance and Inductance has been expanded into two separate chapters, by G. Zickner. The order of presentation in the section on Electricity and Magnetism is not otherwise changed, but the entire section has been revised. In the section on Corpuscles and Energy Quanta considerable new material has been added, the section now including eight chapters instead of three: Ions in Gases, by C. Weiss; Spontaneous Discharge, by H. Herleger; Electronic and Ionic Rays, by H. Fränz; Corpuscular and Quantum Constants, by H. Fränz; The Light-Electric Effect, by H. Verleger; X-Rays, by E. Justi and H. Nitka; Nuclear Radiations, by H. Fränz; and Cosmic Rays, by C. Weiss.

Other Books Received

AERODYNAMICS

The Elements of Aerofoil and Airscrew Theory. H. Glauert. 2nd Ed. Cambridge, at the University Press; New York, The Macmillan Co., 1947. 232 pp., figs. $3.50. First published in 1926, this book was written for the purpose of imparting to students without a knowledge of hydrodynamics an understanding of airfoil and propeller theory. Although great advances in the theory of aerodynamics have taken place since the original date of publication, fundamentals remain the same, and the revised edition should be of considerable value to those who now are taking up the study of the subject. The first five chapters give a brief introduction to those aspects of hydrodynamics which are required for the development of the airfoil theory. Following chapters are devoted to the lift of an airfoil in two-dimensional motion, the effect of viscosity and its bearing on airfoil theory, and the theory of airfoils of finite span. The last three chapters deal with the development of the airfoil theory. Complex mathematical analysis is avoided as far as possible. Because particularly important advances have been made in the theory of viscous motion and the flow of the boundary layer, H. B. Squire, of the Royal Aircraft Establishment, who was a colleague of the late author, has prepared an appendix indicating where important developments can be found. The opportunity also has been taken to replace the nondimensional k coefficients by the now more generally accepted C coefficients. A selected bibliography has been added. In other respects the volume contains few changes.

AIR TRANSPORT

Western Aviation Conference, December 11–12, 1945, Sacramento, Calif. Sacramento, News Publishing Company, 1946. 79 pp. Papers deal with national and state legislation concerning aviation control and the establishment of airports, state planning agencies, the importance of aviation to business and Government executives, the movement of air cargo, and aviation developments in the West.

AIRPLANES

DC-6 Operation Manual. Revised March 21, 1947. Santa Monica, Calif., Douglas Aircraft Co., Inc., 1947. 118 pp., illus., diagrs.

C.A.A. Approved Airplane Operating Manual for the DC-4 Skymaster. November 4, 1946. Santa Monica, Calif., Douglas Aircraft Co., Inc., 1946. 53 pp., figs.

Loading Chart, Equipment List and Weight Data Required for Operation of C54-DC Type Airplanes, Model C54-DC and DC-4. (Report No. 20099, Revised June 5, 1946.) Santa Monica, Calif., Douglas Aircraft Company, Inc., 1946. 54 pp., diagrs., tables.

Airplane Operating Manual for the Model DC-3D Airplane. Santa Monica, Calif., Douglas Aircraft Co., March 25, 1946. 52 pp., illus, diagrs.

AIRPORTS

Rational Airport Planning. Edward Payson Hall. Ferguson, Mo., The Author, 1947. 10 pp., illus., figs. Subjects discussed include the operational aspects of airport design; the development of a polar wind diagram; the percentage of the total time that a given airport may be used for the take-off and landing of aircraft; and the development of a master plan for an airport.

Airports of Tomorrow. Report of the Regional Airport Conference on its Plan for Development of an Airport System for the New York Metropolitan Region. New York, Regional Plan Association, Inc., 1947. 66 pp., illus., tables, maps. Presented in this report is a comprehensive plan for a regional airport system for the New York-New Jersey-Connecticut metropolitan area. An introduction discusses the plan in brief, its origins, the National Airport Plan, civil aviation in the United States, and civil aviation in the region. The chapters following deal with transport landings, supplementary major airports, secondary airports, local airports, seaplane bases, and aviation legislation. An appendix of pertinent data is included.

High Pressure FIDO; A Report on the Babcock and Wilcox Atomizing Burner. V. Gudmundsen and P. J. Macdonald. (Final Report No. 4, Covering Tests Made During 1946.) U.S., Landing Aids Experiment Station, Arcata, Calif., December 24, 1946. 2 Vols. 71, 98 pp.; illus., tables. A review and summarization of developmental work on the high-pressure thermal method of dispelling fog from airfields. It covers in brief form the initial research and development work done by the Babcock and Wilcox Company of Barberton, Ohio, under contract with the Navy Department; the construction of the pilot installation at the Landing Aids Experiment Station; and the results obtained from operating the system under service conditions, together with suggestions for future work directed toward a fully perfected fog-dispersal system.

High Intensity Approach Lights. J. E. Davis and V. Gudmundsen. (Final Report No. 5.) U.S., Landing Aids Experiment Station, Arcata, Calif., January 10, 1947. 48 pp., illus. A brief review of studies relating to the various factors affecting the visibility of approach lights from airplanes is followed by a description of the American Gas Accumulator Company light designed to fulfill the various requirements for a stated minimum visibility condition. The Landing Aids Experiment Station installation of these lights is explained in detail, and the results of flight testing are reported and discussed. Certain alterations and further studies are recommended.

AIRWAYS AND TRAFFIC CONTROL

Electronic Landing Aids. L. H. Johnson and V. Gudmundsen. (Final Report No. 8, Covering Tests from June through December, 1946.) U.S., Landing Aids Experiment Station, Arcata, Calif., January 24, 1947. 19 pp., illus. The electronic aids installed at the Landing Aids Experiment Station are listed, and detailed comments on their maintenance are made, with suggestions for improvements. Low-approach procedure is discussed in connection with the Integrated Landing System.

ATOMIC ENERGY

Introduction to Atomic Physics. S. Tolansky. 2nd Ed. New York, Longmans, Green and Co., 1946. 347 pp., illus., figs. $4.25. Apart from corrections, the second edition of this book on fundamental atomic physics contains few alterations. Minor changes include the recent modification of Townsend's theory of ionization by positive ions, a more satisfactory derivation of Langmuir's thermionic equation, the removal of some obscurity in spectroscopic notation, alterations to six diagrams, and the bringing up to date of the numerical values of the fundamental constants.

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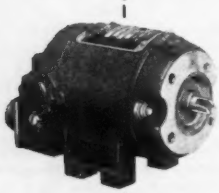

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Atomics for the Millions. Maxwell L. Eidinoff and Hyman Ruchlis. New York, McGraw-Hill Book Co., Ind., Whittlesey House, 1947. 281 pp., illus. $3.50. A book that makes it possible for the reader who has no technical background to understand the basic principles behind the development of atomic energy. It traces this development from early beginnings to the realization of nuclear fission and gives a preview of coming applications of radioactive materials to medicine and industry.

The Problem of Reducing Vulnerability to Atomic Bombs. Ansley J. Coale. Princeton, N.J., Princeton University Press, 1947. 116 pp. $2.00. A study of possible practical methods by which mankind can substantially reduce its vulnerability to atomic warfare, prepared under the direction of the Committee on Social and Economic Aspects of Atomic Energy of the Social Scientific Research Council.

AVIATION INDUSTRY

First Report of the Air Coordinating Committee, 1946. Message from the President of the United States Transmitting First Report of the Air Coordinating Committee, for the Calendar Year 1946. (80th Congress, 1st Session, House of Representatives, Document No. 148.) Washington, Govt. Printing Office, 1947. 48 pp., figs., fold. map. A summary review of work directed toward the coordination of aviation activities. Appendix B, which constitutes the greater part of the document, is a report to the Air Coordinating Committee by the Standing Subcommittee on Demobilization of the Aircraft Industry.

BIBLIOGRAPHY

Subject Guide to United States Government Publications. Herbert S. Hirshberg and Carl H. Melinat. Chicago, American Library Association, 1947. 228 pp. $6.00. The compilers state that this guide represents a selection of books and pamphlets, most of them published during the last 20 years, including titles listed in the *Monthly Catalog* of the Superintendent of Documents through September, 1946. About 3,700 titles are listed under about 1,000 subject headings alphabetically arranged. The emphasis is stated to be upon publications most generally useful in libraries, especially serials, directories, bibliographies, and handbooks. Highly technical items have been generally omitted, and although it is not done consistently, a large part of the serial literature essential to technical reference work in aeronautics is omitted. The coverage is good for the more popular aeronautical subjects, and publications such as the *Civil Aeronautics Bulletins*, *Civil Aeronautics Manuals*, and *War Department Technical Manuals* are entered separately under their appropriate subjects. Some publications issued outside of Washington but at Government expense are included.

CATALOGS

Sweet's File for Product Designers. New York, Sweet's Catalog Service, 1947. 1 Vol. Illus. A bound file of manufacturer's catalogs especially for the use of product-development and design men. It contains essential information on the forms, characteristics, performance, and use of a wide range of materials, equipment, and services, classified under the main headings of materials, finishes, electrical parts, mechanical parts, techniques, and work equipment.

DIRECTORIES

Industrial Directory of New York State, 1946. Albany, New York State Department of Commerce, 1947. 836 pp., map. Superseding the previous directory compiled in 1940, this volume contains the names of approximately 36,000 selected manufacturing and mining establishments of New York State. Concerns are listed alphabetically, by products, and geographically.

ELECTRICITY

Electrical Handbook; A Convenient Book of Reference for Electrical Engineers and Electricians. Scranton, International Correspondence Schools, 1942. 382 pp., illus., figs., tables. $1.00.

A pocket-sized reference book for engineers and others working in the electrical field. In addition to useful tables, there are sections on electrical units, direct-current machines, electric batteries, a.c. motors, transformers, rectifiers, transmission and distribution, electric wiring, electric heating and distribution, electrical measurements, and electroplating.

FILMS

Educators Guide to Free Films. 7th Ed. Randolph, Wis., Educators Progress Service, 1947. 339 pp. $5.00. Indexed in this guide are over 135 motion-picture and slide films on aeronautical subjects, with description, running time, and source.

FLIGHTS

Statistik der Oceanflug (Transoceanic Flight Attempts) 1910–1940. Arthur Flury. (Berne, Switzerland, The Author.) New York, Distributed by International News Co.; Friederich Krause; Oscar Neuer; and Stechert-Hafner, Inc., 1947. 3 folded tables. 6 Swiss fr. Data are presented in German, French, and English on 290 attempted transoceanic flights, between 1910 and 1940, omitting test flights and regular air-mail services and scheduled Atlantic flights by Zeppelins. The time of landings and take-offs, including stopping places, is given in mean European time. The presence of radio equipment on the plane is indicated. In comparison with Piero Botto and Armando Silvestri's *Atlanta Anni di Transvolate Oceaniche*, Rome, 1940, this compilation has the advantage of presentation in three languages and slightly more detail on each flight, but the Italian work records more than 600 attempts to fly the oceans.

HELICOPTERS

Helicopter Research and Development. C. G. Pullin. (Reprinted from the Bulletin of The Helicopter Association of Great Britain.) Twickenham, Middlesex, the Riverside Press, Ltd., 1946. 62 pp., illus., figs. The text of a lecture in which the author presents a résumé of the helicopter research and development work with which he has been entrusted during the past 14 years as Chief Designer of the Cierva Autogiro Co., Ltd. Various phases of the subject are discussed, some of which include rotor blade mounting, rotor systems, rotor blade design, stability and control, transmission, and mechanical details.

MAINTENANCE

A Guide to the Aircraft Maintenance Engineer's Licence Examinations. 2nd Ed. London, The Society of Licensed Aircraft Engineers, April, 1947. 72 pp. 5*s.* 6*d.* This guide has been compiled to assist those who are preparing to obtain a British aircraft maintenance engineer's license. It includes information about the categories of licenses; the duties of engineers licensed in various categories; the procedure for the grant, extension, and renewal of the aircraft engineers' "M" license; the form of the examination; the syllabus of examination; and preparing for the examination.

MATERIALS

Index to A.S.T.M. Standards. Philadelphia, American Society for Testing Materials, 1946. 234 pp.

MATHEMATICS

Mathematical Methods of Statistics. Harald Cramér. (Uppsala, 1945.) Princeton, N.J., Princeton University Press, 1946. 575 pp., figs. $6.00. An exposition of the mathematical theory of modern statistical methods based on the concept of probability. The author discusses the fundamental concept of a distribution and of integration with respect to a distribution; the general theory of random variables and probability distributions; and the theory of sampling, statistical distributions, and tests of significance. The material has been used for several years in a two-semester course at Princeton University. A good working knowledge of the elements of differential and integral calculus, algebra, and analytic geometry is prerequisite for the reader. A list of references to books, periodicals, and tables is appended.

Differentialgleichugen Reeler Funktionen (The Differential Equations of Real Functions). E. Kamke. (Leipzig, 1930.) New York, Chelsea Publishing Co., 1947. 436 pp., figs. $3.95. The scope of this college textbook is confined solely to the differential equations of real variables in order to permit a clear-cut development of the concepts and proofs involved. This limitation has made room for a more accurate investigation of some of the "elementary" differential equations than is customary. A treatment of Lindelöf's demonstration of the existence of real analytical functions and the proof of Knopp and R. Schmidt for the principle of functional determinants are included. Certain subjects had to be omitted, such as the theory of multipliers and the notion of general, particular, and total integrals.

Lehrbuch der Funktionentheorie. Band I. Elemente der Funktionentheorie. Band II. Moderne Funktionentheorie. (Textbook of the Theory of Functions. Vol. I. Elements of the Theory of Functions. 4th Ed. Vol. II. Modern Theory of Functions. 2nd Ed.) (Leipzig, 1934, 1931.) New York, Chelsea Publishing Co., 1945. 2 vols., 322, 370 pp. $6.50. Professor Bieberbach's textbooks are usually among recommended mathematical books. His treatment of analytic functions in this book has been described as superb, and the general scope of the book is broader than that of most on the subject.

Vector and Tensor Analysis. Louis Brand. New York, John Wiley and Sons, Inc., 1947. 439 pp., figs. $5.50. A book written to provide the student with an understanding of the theory and simpler applications of vector and tensor analysis in ordinary space, and also such concepts as dyadics, matrices, motors, and quaternions. An introduction to the algebra of motors is included because of its increasing importance in mechanics as well as in line geometry. The entire theory is illustrated by significant applications. Special chapters are devoted to surface geometry and hydrodynamics. Problems for solution by the student are appended to each chapter.

Essentials of Analytic Geometry. David Raymond Curtiss and Elton James Moulton. Boston, D. C. Heath and Co., 1947. 259 pp., figs. $2.80. The principles of plane and solid analytic geometry are presented as preparation for calculus and for engineering courses. Supplementary exercises are included at the end of some chapters.

MECHANICAL ENGINEERING

Mechanics' Handbook. Scranton, International Correspondence Schools, 1943. 382 pp., illus., figs., tables. $1.00. This pocket-sized handbook contains useful tables and includes chapters on mechanical principles, materials of engineering, plastics, strength of materials, shop work, and other subjects of interest to mechanical engineers and mechanics.

MEDICINE

Psychological Disorders in Flying Personnel of the Royal Air Force Investigated During the War, 1939–1945. (Gt. Brit., Air Ministry, Air Publication 3139.) London, H.M. Stationery Office, 1947. 344 pp., figs. 7*s.* 6*d.*

METALLURGY

Revised Scheme for the Establishment of the National Metallurgical Laboratory. Delhi, Council of Scientific and Industrial Research, 1946. 25 pp., fold. diagrs., tables. When completed, the laboratory at Jamshedpur, India, will cover all aspects of metallurgical research, both fundamental and applied, and will also carry out research work on ores, minerals, and refractories as applied to metallurgy. Particulars are given about physical arrangement and costs.

METEOROLOGY

Meteorology. K. L. Gardner, J. R. Holloway, and others. (Final Report No. 9, Covering Work Done During 1946.) U.S., Landing Aids Experiment Station, Arcata, Calif., January 31, 1947. 93 pp., illus., diagrs. An examination of phases of meteorology relating to the problem of landing aircraft safely during periods of low visibility. Applicable information on the nature of fog is presented. Various possible methods of dissipating fog are discussed, including the thermal method, the feasibility of which has been demonstrated in full-scale operation. The measuring instruments found useful in investigating fog and its dispersion are described.

Dynamic Persistence and Its Applications to Long-Range Foreshadowing. Irving I. Schell. (Harvard Meteorological Studies No. 8.) Milton, Mass., Blue Hill Meteorological Observatory, 1947. 80 pp., tables, maps. $1.00.

The Exposure of the Anemometers at Aberdeen. G. A. Clarke. (Gt. Brit., Air Ministry, Meteorological Office, Professional Notes No. 90.) London, H.M. Stationery Office, 1947. 23 pp. illus., diagrs. 9*d.*

MODELS

Petrol-Engined Model Aircraft. C. E. Bowden. London, Percival Marshall and Co., Ltd., 1946. 230 pp., illus., diagrs. 7*s.* 6*d.*

Model Planes for Beginners. H. H. Gilmore. New York, Harper and Brothers, 1947. 95 pp., illus. $1.50.

NAVAL AVIATION

Fundamentals of Naval Warfare. Lee J. Levert. New York, The Macmillan Co., 1947. 488 pp., diags., figs. $5.00. An outline of the principles and methods of Naval warfare including chapters on the general characteristics of the various types of aircraft, rocket-propelled and jet-propelled flying bombs, and the aircraft carrier.

NAVIGATION

A Report on the Theory and Application of Single Heading Flight; Additional Conclusions and Possibilities of Pressure Navigation. U.S., Navy Dept., Office of Research and Inventions, Special Devices Div., Washington, March, 1946. 49 pp., figs., maps, tables. A further investigation is presented of the possibilities of making use of the weather in the determination of the best flight path between two points. The pamphlet discusses conclusions drawn from recent experience with single heading flight—i.e., flight in which the draft angle is calculated in advance and applied to the true heading between the point of departure and destination. Sections deal with the theory of the method, its limitations, and recommended procedures. There is an appendix containing an analysis of flight trials and other information and data. A list of 14 references is included.

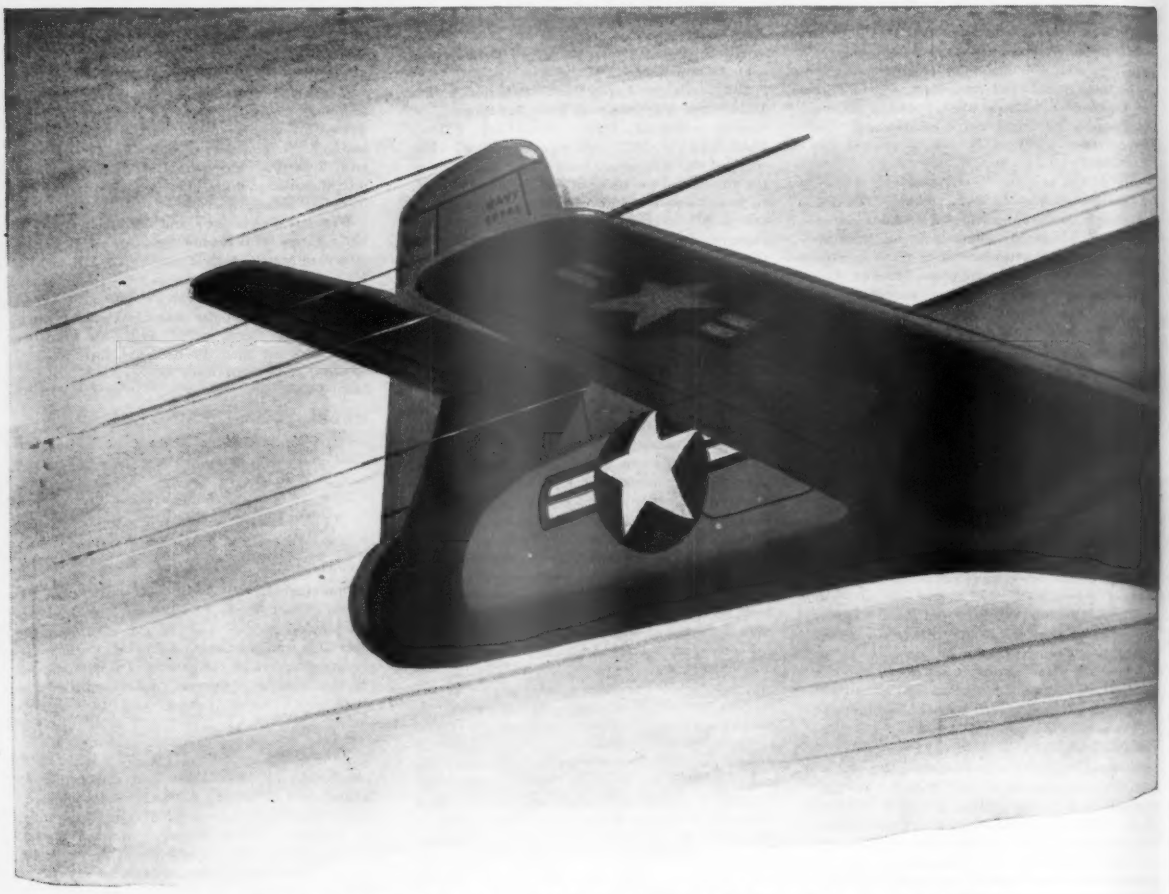
PATENTS

Inventions and Their Managements. A. K. Berle and L. S. De Camp. 2nd Ed. Scranton, International Textbook Co., 1947. 742 pp., illus., figs. $6.00. A revised edition of a book presenting the principles and practices governing the technical, legal, and business procedures of invention. The principal changes include a discussion of the Lanham Act and the influence it will have on the U.S. trade-mark law and the addition of a chapter on trends in industry, research, and inventions; a number of minor revisions also have been made. The Appendix contains a short list of books on patents, trade-marks, and research, patent law associations, libraries containing Patent Office publications, and a glossary of terms.

PRODUCTION

Men and Volts at War; The Story of General Electric in World War II. John Anderson Miller. New York, Whittlesey House, McGraw-Hill Book Co., Inc., 1947. 272 pp., illus. $3.75. An account of how the General Electric Company mobilized its experience, skill, and resourcefulness for America's war effort. It tells about the great variety of war equipment the company produced and some of the many complex problems it was

(*Continued on page 83*)



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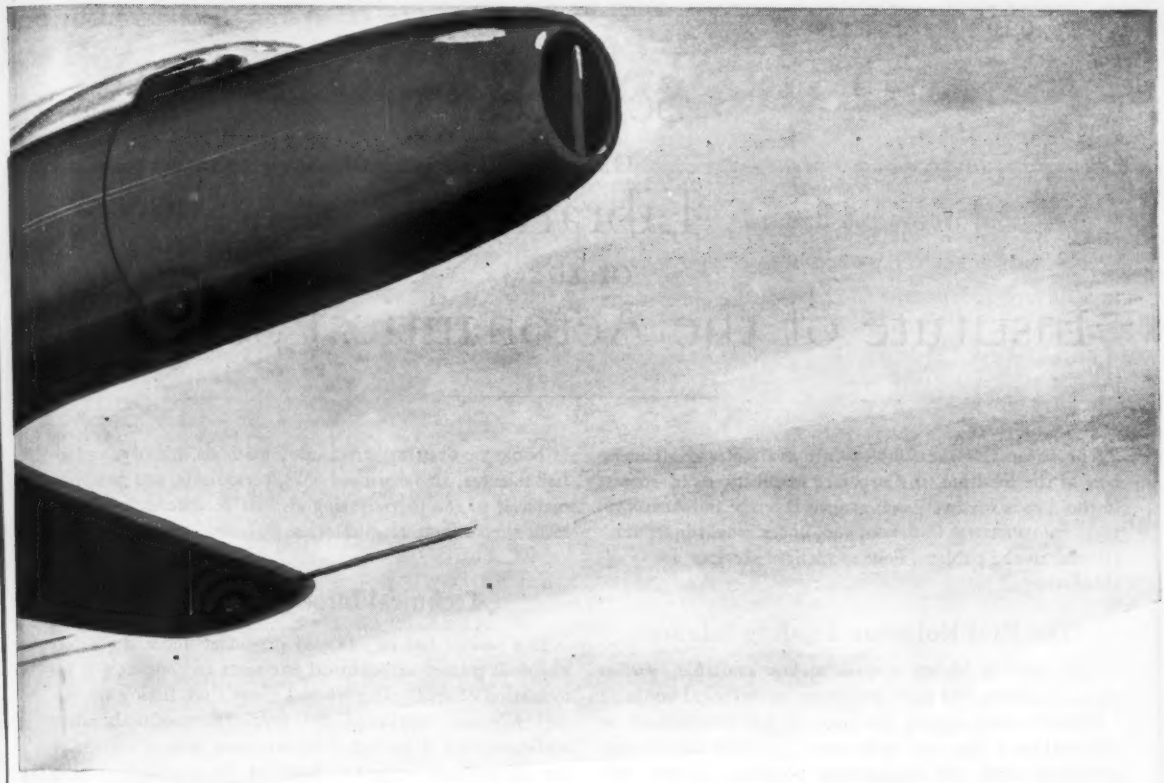

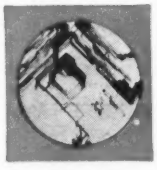

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Technical Information Service

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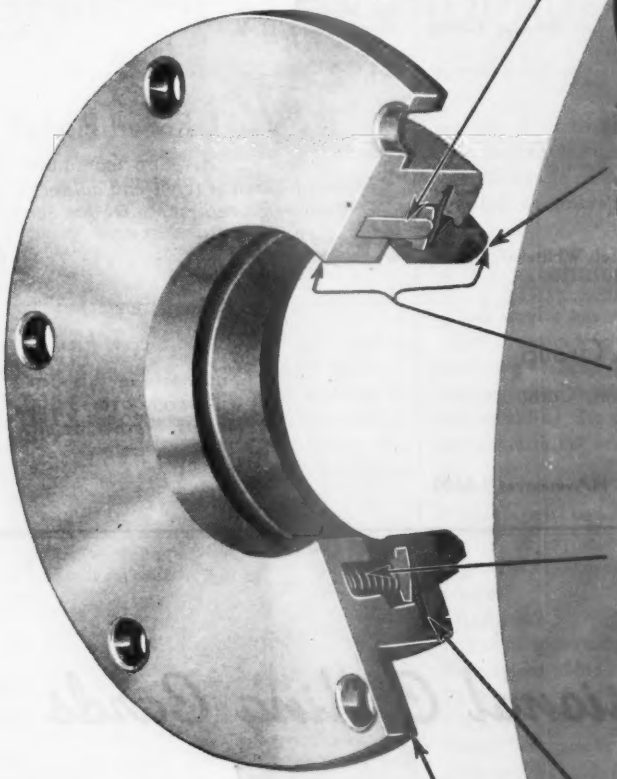

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Personnel Opportunities

This section is for the use of individual members of the Institute seeking new connections and organizations offering employment to aeronautical specialists. Any member or organization may have requirements listed without charge by writing to the Secretary of the Institute.

WANTED

The U.S. Naval Air Station, Pensacola, Fla., is accepting applications of highly qualified and experienced personnel for various positions as follows: **Industrial Engineer,** P-6 at $7,102.20 per annum, P-3 at $4,149.60 per annum; **Organization and Methods Examiner,** CAF-9 at $4,149.60; **Methods Examiner—Forms,** CAF-7 at $3,397.20 per annum; **Engineer Draftsman—General,** SP-6 at $2,644.80 per annum; **Statistical Draftsman,** CAF-5 at $2,644.80 per annum. Applicants may obtain Civil Service Application Form 57 from their local post office. Forward applications, completely filled out, to the Recorder, Board of U.S. Civil Service Examiners, U.S. Naval Air Station, Pensacola, Fla.

Professors and Instructors in Aeronautical Engineering—With the changed Aeronautical Engineering course from 4 to 5 years and extended graduate study facilities, the University of Minnesota, Department of Aeronautical Engineering, has positions available for a full professor in aeronautical engineering with industrial experience; assistant professor in modern theoretical and applied aerodynamics; and two instructors in the field of general aeronautics. Applicants must have Aeronautical Engineering degree and M.S. degree for higher positions. Extra compensation for summer work and opportunities for part-time research. Address: Department of Aeronautical Engineering, University of Minnesota, Minneapolis, Minn.

Assistant Professor—To teach courses in aircraft structures. The primary duties of the position will be concerned with aircraft structures, but the applicant should possess enough knowledge of aerodynamics to permit him to assist occasionally in elementary aerodynamic courses. Prefer a man with teaching and practical experience. In applying, please give brief sketch of personal qualifications, education, and experience. Address: Acting Dean R. P. Davis, College of Engineering, West Virginia University, Morgantown, W.Va.

Aircraft Dynamics Engineers—For research work on subsonic and supersonic flutter, vibration, dynamic loads, stability and control of supersonic missiles, and helicopter dynamic problems. Applicants must have good background in fundamentals of applied mechanics and mathematics. Advanced degree or previous experience in field is essential. Salaries commensurate with training and experience. Cornell Aeronautical Laboratory, Employment Office, 4455 Genesee St., Buffalo 21, N.Y.

Servomechanism Engineers—Experienced in analysis, design, or testing of electrical or hydraulic servomechanisms or powered flight controls. Strong knowledge of stability analysis and test methods desired. Salary commensurate with training and experience. Inquire Personnel Manager, Boeing Aircraft Company, Seattle 14, Wash.

Structures Engineers and Stress Analysts—Experienced in aircraft structures and stress analysis. Three to 10 years or more experience desired. Salary commensurate with training and experience. Inquire Personnel Manager, Boeing Aircraft Company, Seattle 14, Wash.

Hydraulic Engineers—Experienced in design and analysis of aircraft hydraulic mechanisms and components. Salary commensurate with training and experience. Inquire Personnel Manager, Boeing Aircraft Company, Seattle 14, Wash.

Mechanical Design Engineers—Experienced in design of light high-speed rotating machines. Also experienced in light and medium aircraft-engine and engine accessory design. Salary commensurate with training and experience. Inquire Personnel Manager, Boeing Aircraft Company, Seattle 14, Wash.

Structural Designers—Engineers experienced in design of sheet-metal structures desired for large cargo aircraft project. Graduate engineers preferred. All replies held confidential. Write, Project Engineer, Chase Aircraft Company, Inc., West Trenton, N.J.

Layout Draftsmen—Six or more years' experience in aircraft layout and design. Cargo aircraft experience desired. Graduate engineers preferred. All replies held confidential. Write, Project Engineer, Chase Aircraft Company, Inc., West Trenton, N.J.

Stress Analysts—Personnel with experience on sheet metal, monocoque, cargo-type aircraft desired. Graduate engineers with 5 or more years' experience preferred. All replies held confidential. Write, Project Engineer, Chase Aircraft Company, Inc., West Trenton, N.J.

Chief Aerodynamicist—Services of highly qualified person to act as chief aerodynamicist. All applicants must be graduate engineers of recognized universities. Experience on cargo or large type of aircraft desirable. Applicants should write, giving complete details of education and experience, list references and salary expected, as well as availability. All replies held confidential. Write, Project Engineer, Chase Aircraft Company, Inc., West Trenton, N.J.

Aerodynamicists—Several positions open to qualified personnel for performance and load calculations on cargo-type aircraft. Graduate engineers preferred with at least 5 years' experience. All replies held confidential. Write, Project Engineer, Chase Aircraft Company, Inc., West Trenton, N.J.

Engineers—Attention newly graduated engineers: Opportunities for wide-awake hustlers who want to learn. Write, giving full particulars of scholastic record and any experience, to Project Engineer, Chase Aircraft Company, Inc., West Trenton, N.J.

Assistant Professor—Assistant Professor of Aeronautical Engineering wanted to teach junior and senior courses at Oregon State College. A man with graduate degree, teaching and industrial experience preferred. Address replies to B. F. Ruffner, Oregon State College, Corvallis, Ore.

Educators and Specialists—Pacific Northwest opportunity for aeronautical educators and engineering specialists. Advanced degree required, plus enthusiasm for graduate teaching and research. Excellent laboratory facilities available. Address inquiry to Aeronautical Engineering Department, University of Washington, Seattle 5, Wash.

762. Engineer—Graduate engineer, mechanical, experienced in precision transmission systems. Aggressive expanding company. Suburb of Philadelphia. Replies will be kept confidential. Send complete résumé.

761. Junior Electrical Engineers—Graduate engineers from recognized universities preferred. To work on aircraft electronic systems. Plant located in suburb of West Philadelphia. All replies will be held confidential.

760. Aircraft Electronic Engineer—Experienced in flight-test instrumentation. Plant located in suburb of West Philadelphia. All replies will be held confidential.

742. Automatic Pilot Project Engineer—Wanted by leading manufacturer of electromechanical equipment with a complete automatic pilot staff, including top-notch gyro engineers, servo engineers, and electronic engineers. Requires experienced automatic pilot engineer to take charge of automatic pilot engineering to relieve company chief executive who has handled this personally heretofore but requires a project engineer because of increased work and expanding program. Individuals in our employ know of this opening so applicant need not be concerned about writing to his own employer. Location Middle West.

741. Metallurgist—College graduate with several years' experience in aircraft industry on control of materials, processes, and process inspection. To assume charge of quality control. An expanding aircraft concern, with excellent future. All replies will be held confidential. East Coast company.

739. Instructor or Assistant Professor—To teach courses in aircraft structures or aerodynamics in Aeronautical Engineering Department in Midwestern university. Minimum of 5 years' practical experience required; master's degree and previous teaching experience desirable. In replying please give complete record of personal qualifications and experience.

730. Aeronautical Engineer—Civil Service position open in Washington, D.C., for aeronautical engineer with experience in stability and control analysis. Salary $4,902 per annum. In applying please give brief sketch of personal qualifications, education, and experience.

724. University Airport Operations Director—Director of Operations position available at airport owned and operated by a large mid-western university. The director should be a pilot and a graduate engineer, have had some experience in operating an airport, and have an interest in flight research and flight training.

The number preceding the notices represents the Box Number of the Institute of the Aeronautical Sciences to which inquiries should be addressed.

AVAILABLE

779. Aeronautical Engineer—B.Ae.S. degree, University of Minnesota, 1940. Age 31, married. Six years' experience with prominent aircraft propeller manufacturer involving drafting, weight control, aerodynamics, plus extensive experience in installation engineering pertaining to aircraft propellers. Held supervisory position in Installa-

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tions Department at time of resignation to form own airport operations organization. Location open.

778. Aeronautical Engineer and Executive—Nineteen years' aircraft experience. Age 40, A.E. degree. Last 12 years with large aircraft manufacturer includes 6 years in charge of hull and fuselage design, 4 years as chief project engineer, and 2 years as head of design department. Generally familiar with Army, Navy, and C.A.A. regulations and specifications. Desires responsible position in aircraft design or related field. Prefers East of Mississippi. Immediate availability.

777. High School Aeronautics Teacher—Age 29, married. Author of three technical books on aviation education, aircraft operations, aviation course of instruction for high schools and colleges. Twelve years' practical experience in operational aviation, all phases. Seven years' aviation teaching experience. Teaching aeronautics in a Southern high school at present. Would like better position teaching basic or primary aerodynamics and/or structures in a college offering aeronautical engineering or aeronautical courses.

776. Sales Engineer—B. in A.E., Rensselaer Polytechnic Institute; age 26, married. Four and one-half years' research experience plus 20 months spare-time study (International Correspondence Schools) of corporate organization and finance, business law, accounting, and marketing. Private pilot. Desires sales engineering connection in industry where the combination of sales ability with a sound engineering background will be valuable. Location open. Salary incidental to advancement opportunities.

775. Aeronautical Engineer—B.S. in Aeronautical Engineering. Age 28, single. Thirty-two months' experience, 17 months in design layout, 15 months in flight testing. Desires position in Eastern United States in flight testing or research. Will consider design layout.

774. Engineer—Age 26, married. B.Ae.E., N.Y.U., 1944. One year of graduate work at N.Y.U. including courses in compressible flow, gas turbines, structural analysis, and advanced mathematics. Expects M.Ae.E. in October upon completion of thesis. Two years' experience in maintenance and inspection of A.A.F. transport aircraft as engineering officer both in U.S. and Pacific Theater. Location open.

773. Pilot—Engineer—B.S.Ae.E. from Purdue University. Age 25, single. Presently holds valid commercial pilot's license with single- and multi-engined, instrument, and instructor ratings. Acquired extensive experience as B-29 flight engineer during war. Leaving present position as flight supervisor at large Midwestern university airport. Interested in sales engineering, pilot for private concern, or flight-test work. Will locate anywhere but prefers East Coast.

772. Aeronautical Engineer—Aerodynamicist; B. Aero. E., N.Y.U., 1943. Age 24, married. Four and one-half years' experience in all phases of aerodynamics (propeller and jet aircraft), with emphasis on flight test and performance analysis; experience in supersonic aerodynamics pertaining to guided missile development. Will consider college teaching. Metropolitan New York, Northern New Jersey, and Long Island areas preferred. Details and references upon request.

771. Mathematician — Engineer — Age 33; B.S., M.A., 60 graduate credits in mathematics; 4 years' evening mechanical engineering course. Six years' experience teaching mathematics; 2 years' experience in aerodynamics, including transonic and supersonic aircraft and missiles; 1 year as research engineer on auto pilot and hydraulic shock absorbers; 2 years' administrative experience as manager of service department with manufacturer of aircraft hydraulic pumps and landing gears. New York, New Jersey, or Long Island area preferred.

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770. Aeronautical Engineer—B.Ae.E., 1942. Age 25, married. Two years' experience in design evaluation of regular and experimental aircraft. Two years' experience in aircraft flight testing and aircraft maintenance. One year's experience in supersonic research leading to the design of guided missiles. At present engaged as a research technician in supersonics. Desires position as an administrative or project engineer. Familiar with Government contracts and procedures.

769. Aeronautical Engineer—B.S. in M.E. (Aero.), 1942. Age 27, married. Five years' experience in layout and design on military and commercial aircraft. Some experience in wind-tunnel testing and aeronautical research. Desires permanent position with leading aircraft concern. Will locate anywhere in United States.

768. Production-Management Engineer—B.Ae.E., Rensselaer Polytechnic Institute, 1942. Five years' experience in engineering and management, including duties in liaison, salvage, design, and stress analysis. Three years' aircraft engineering officer in U. S. Marine Corps in complete charge of third echelon maintenance, repair, and overhaul, as well as command responsibilities. Desires responsible position requiring managerial capabilities in addition to engineering knowledge, such as production planning and control.

767. Aeronautical Engineer—Age 23, married. Four years' experience in air-transport field. Thoroughly familiar with aircraft structures and systems, weight and balance procedures, structural repairs, and servicing. Two years' experience in detail design and interior furnishing of large commercial aircraft including DC-3, DC-4, and L-49 aircraft. Desires position of responsibility in which engineering background will be of value. Available immediately.

766. Aeronautical and Mechanical Engineer—Age 25. B.S. in G.E. with A.E. Option from Georgia School of Technology. Considerable work toward M.S. completed. Three years' experience in the development of aircraft engines (conventional and jet) and propellers in the Engineering Division, Air Matériel Command, Wright Field as an officer. One year's experience in theoretical analysis of power plants, rocket research and development, and aerodynamics for guided missiles. Considerable experience as a pilot. Interested in sales engineering. Will locate anywhere. No objection to traveling. Good references.

765. Aeronautical Engineer—Age 28. B.S. in Mechanical Engineering from Illinois Institute of Technology. S. M. in Aeronautical Engineering from Graduate School of Engineering, Harvard University. Thirty months' Navy experience with the Bureau of Ordnance Aviation, Ordnance Section. Experience includes design, layout, drafting, and stress analysis of ordnance equipment. Desires work in experimental aircraft design and stress analysis.

764. Engineer—Ph.D., Master's, and Bachelor's degrees; age 30. At present, Director of Aeromechanics Department for large corporation engaged in research, design, and development in supersonic and subsonic guided missile programs. Formerly, Associate Professor of Aeronautical Engineering at midwestern university, teaching theoretical aerodynamics, supersonic and compressible subsonic flow, dynamic stability, and wind-tunnel courses. Desires professorship or associate professorship at recognized university with the possibility of some research or consulting or a responsible position in industry with good future prospects.

763. Teacher—Desires position teaching aeronautical engineering at recognized college or university. B.A.E. degree, magna cum laude. Graduate work in engineering partially completed. Three years of progressively responsible industrial experience, including analysis and design of tubular and stressed-skin structures and of the mechanical elements of civilian and military aircraft, with emphasis in rotary wing field. One and one-half years' experience as instructor of mechanical engineering at accredited college. Qualified to teach courses in aerodynamics, fluid mechanics, advanced strength of materials, airplane design, structures and stress analysis, and rotary wing aircraft.

759. Powerplant and Engine Accessory Designer—Graduate M.E., German university. Extensive design and testing experience. Fully conversant with engine layout and all phases of development. Considerable design and research background on fuel injection systems.

757. Flight Test or Research Engineer—Aeronautical Engineering graduate with 5 years' experience in flight testing, flight research, and wind-tunnel testing. Has done military and C.A.A. acceptance flight tests. Special experience with large aircraft test organization. Intends to leave West Coast. Desires equivalent position in the East; New York or New England Coast preferred.

756. Aeronautical Engineer—B.S. in Ae.E., age 24, single. Two years' maintenance engineering experience with the Army Air Forces. Fourteen months' experience as test engineer, mechanical laboratory, and test engineer in charge of stratosphere chamber with leading rotary wing and rocket airplane manufacturer. Desires position in structural, altitude, or wind-tunnel testing. Details and references upon request. Location open.

755. Mechanical Engineer—B.S. in Mechanical Engineering, age 28. Three years of performance estimation of gas turbines and thermodynamic analysis and design of gas turbine components. Three years of mechanical design of aircraft elements. Desires a responsible position with an active organization with plenty of work and an opportunity for advancement. Location unimportant.

754. Aeronautical Engineer—B.S. in Aeronautical Engineering, age 26. Forty months' experience in the Army Air Corps as an engineering officer in charge of maintenance and equipment development. Desires position in aerodynamic research but will also consider other positions. Sound theoretical background in stress analysis and aerodynamics as well as practical experience in heavy aircraft maintenance. Details and references upon request.

753. Engineer—B.M.E., 1943. Nine months' as assistant project engineer on automatic aircraft control. Two years as aerodynamics engineer on piloted and pilotless aircraft. For past 6 months in charge of projects to simulate in laboratory the behavior of guided missiles and their control equipment while in flight. Desires improved opportunities.

752. Engineer—Age 36, 3 years' college engineering; 2½ years as an engineer in the aircraft industry; specialist in weights and balance; holds valid A. & E. license; approximately 10 years all-round technician on all types of aircraft. Would like to represent aircraft manufacturer in the field.

751. Aeronautical Engineer—Seven years' air-line and manufacturing experience, mostly on heavy multiengined aircraft covering tool design, group leader equipment installation design, service and liaison engineering, flight testing, direction of preparation of flight and maintenance handbooks, and progressive maintenance systems for U.S. Navy and a major air line. Desires responsible position with air line or manufacturer, domestic or foreign. Excellent references furnished.

750. Aeronautical Engineer—B.Ae.E., age 24, single. Two years' experience in flight testing, primarily jet-propelled aircraft. Three and one-half years with A.A.F. as navigator, experimental engineering officer, and administrative officer. Seeks position in aeronautics, preferably development and/or liaison.

748. Aeronautical Engineer—Bachelor's and Master's degrees in Aeronautical Engineering. Presently holding responsible executive position with well-known helicopter manufacturer. Desires new connection either in industry or at recognized university. Broad general aircraft experience; author of several published papers on rotating wing aircraft and general design; well-known in industry and C.A.A. circles; teaching experience in field of structural design.

747. Helicopter Flight Test Engineer—Age 27, married. B.S.E. (Aero.), 1943. Familiar with C.A.A. flight test procedures and data reduction necessary for helicopter certifications. Four years' aviation experience includes flight-test instrumentation, conventional aircraft flight scheduling. Desires position in Midwest in related or nonrelated field where background would be of some benefit.

746. Aerodynamicist—Age 28; B.S. and M.S. degrees in Ae.E. Five years' experience in aerodynamic design of commercial and military aircraft. Considerable experience with static and dynamic stability analyses of aircraft. Desires responsible position either with aeronautical college or with aircraft industry.

745. Aeronautical Engineer-Teacher—Presently employed design engineer would prefer a change to teaching position. Work in aircraft industry or in aero-insurance field also desirable. Scholastic record includes B.S. degree in Mechanical Engineering and graduate study in applied mechanics, plus M.S. degree from Harvard Graduate School of Engineering. Over 6 years' industrial experience on gliders, large (four-engined), and small aircraft, amphibians and jets. Has been chief of structures and aerodynamics on light aircraft; handled approval of important aircraft designs while working for C.A.A.; has also handled safety and accident analysis, and C.A.A. design and liaison work for large aircraft manufacturer. Teaching experience includes graduate assistantship at leading university and appointment as Instructor in Aeronautical Engineering on part-time basis.

744. Project Engineer—Age 29; M.Ae.E. Nine years' experience in design and development of aeronautical and mechanical components. Recent experience in guided missiles and in direction of groups engaged in aeronautical development work. Especially interested in coordination of new development work.

743. Aeronautical Engineer—Bachelor of Ae.E., Master of Ae.E. from New York University, majoring in aircraft structures. One and one-half years' experience as student and graduate assistant and some experience in research department of large Eastern aircraft company. Interested in obtaining position in structural research or structural test.

740. Aeronautical Engineer—B.S. in Aeronautical Engineering. Nineteen years' experience in military and commercial development and flight testing. Specialized in aerodynamics, flight test, power plants, and weights. Has professional license. Desires position in development of personal airplane. Interested in Southern California location.

738. Aviation Representative—Executive. Married. Seven years' air-line experience. Possesses good working knowledge of all departments. Broad communications experience—supervisory and administrative. Some flying experience plus working knowledge of dispatching, meteorology, instrument flying, and navigation. Alert, reliable, mechanically inclined. Executive ability. Interested in organizing a helicopter operation, or cargo or feeder air-line. Will consider responsible position with an organization needing a well-informed aviation representative. Will furnish references on request. Interview desired.

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737. Engineer—Age 33, married. Aeronautical and mechanical engineering education. Nine years' experience in aircraft industry including all phases of design and analysis of airplane structures. Would like position with growing concern. East Coast preferred.

736. Spare Parts Requirements Specialist—Graduate of 2-year aeronautical engineering technical college; C.A.A. mechanic's license; 3 years with A.T.C. and A.T.S.C. as assistant aircraft maintenance officer specializing in scheduling the repair of spare parts and anticipating need for same before actually needed. Presently employed and has 2 years' experience with a major air line, mainly in provisioning spare parts. Has a thorough practical knowledge of engineering and maintenance problems and practices. Desires connection with an air line or company planning to enter the air transportation business. Preference is New York Area.

735. Engineer—B. of A.E., 1942, with honors. Postgraduate study in mathematics. Training background includes extensive experience as a machinist and as a draftsman. Flying experience. Experience as development engineer working on all phases of aircraft propeller theory, testing, and production. Two years as an engineering officer in the U.S. Navy. Last duty as an administrative engineer with the Office of Research and Inventions. Experience with large aircraft company as a research aerodynamicist working on subsonic and supersonic rocket aircraft. Design engineer, procurement engineer, and sales engineer with mechanical machine company. Exceptional administrative and sales ability. Personable appearance and can deal effectively with people. High engineering aptitude and understanding proved many times in practice.

734. Aircraft Equipment Engineer—Age 33, married. Fourteen years' experience, including: 1 1/2 years as aircraft mechanic; 2 1/2 years as assistant chief engineer small aircraft plant; 1 1/2 years as group leadman on experimental aircraft project, doing layout, lofting, stress analysis, weight and balance; 8 years with major aircraft company as layout draftsman, engineering designer, shop liaison engineer, modification and salvage engineer. Research and development work on passenger comfort and lightweight seating. Familiar with Army and C.A.A. regulations. Desires chance for advancement with manufacturer, research organization, or maintenance base. Prefers West Coast.

733. Engineer—Nine years' experience in manufacturing and materials and process engineering. Also some experience in stress analysis, structural testing, and design. Desires position in materials and processes, research, production design, or manufacturing field with air-line, airframe, or accessory manufacturer.

732. Chief Power-Plant Engineer—B.S. in M.E. Twenty years' experience in airplane design as draftsman, weight computer, stress analyst, flight test observer, project engineer, power-plant engineer, and chief power-plant engineer. Fifteen years as power-plant installation specialist. In charge of power-plant design and technical calculations for many outstanding military and commercial airplanes. Turbojet and rocket experience. Successful administrative record in handling design groups. Desires administrative position with progressive firm in engineering department of aircraft company or in installation department of engine manufacturer.

729. Plastics Engineer—B.S. in M.E., Cornell, 1940. Age 30, married. Wishes to organize low-pressure molding department or section of laboratory for aircraft concern designing surfaces that must carry radar equipment or have supersonic smoothness. Five years' experience in aircraft applications of plastic resins, thoroughly familiar with practical laboratory and production techniques; also with design and lofting requirements for low-pressure molds.

727. Tool-Production Engineer—Age 34. Fifteen years' experience sheet metal and precision metalworking fields in production supervision, tool design, aircraft layout drafting, production engineering. Last 8 years in aircraft, last 2 years as Chief Tool Engineer. Capable administrator, considerable experience in labor relations. Desires position in tool or production engineering leading to responsible position requiring administrative ability.

726. Aeronautical Engineer—B.S. in Ae.E., 1942, plus additional engineering studies. Age 25, single. Five years' experience, including 3 years' layout design and 2 years' engineering experience in another field having to do with the fabrication and production design of ceramic product. Experience in processing, testing, research, and field service in capacity of Practical Engineer. Prefers position in administrative capacity, field service or design group. Free to travel anywhere. Complete information will be given on request.

725. Airplane Structures Engineer—B.S. in M.E. from recognized state university. Five years' experience in airplane structural design, major stress analysis and air loading with leading aircraft manufacturers and 3 years of experience with Federal Government agencies having cognizance of aircraft airworthiness. Some teaching experience and author of text on flight loads. Desires position in aeronautical or mechanical engineering or teaching involving structural design, stress analysis, fluid mechanics, or other analytical or research work.

723. Aeronautical Engineer—Young Puerto Rican, 20 years old, American citizen; graduate of Academy of Aeronautics, February, 1947. Speaks and writes Spanish. Will accept position in New York, Puerto Rico, or South America.

722. Research Engineer—Age 29, married. B.S. Ae.E., 1943. M.S. Ae.E. expected in 1947. Three and one-half years' research experience including general aerodynamics and subsonic and supersonic wind-tunnel testing. Supervisory experience.

Books

(*Continued from page 73*)

called on to solve. Of particular aviation interest are the chapters on Propulsion for Aircraft, Electricity in the Air, and Aids to Fighters.

Great Engines and Great Planes. Wesley W. Stout. Detroit, Chrysler Corporation, 1947. 133 pp., illus. This book reviews the birth and development of the Boeing B-29 Superfortress and its engines and describes some of the contributions of this airplane to the successful conclusion of the late war. The reader is provided with a conception of the research, planning, and preparation that must precede a manufacturing undertaking of this magnitude. Particulars are given about the work carried out at the Dodge-Chicago plant of the Chrysler Corporation where Wright 18-cylinder engines for the B-29 were manufactured.

Bird's-Eye View of Beaufort: Beaufort—Beaufighter—Lancaster Production in Australia. 3rd Ed. Australia, Department of Aircraft Production, Melbourne, April, 1945. 36 pp., illus. Various phases of the widespread operations involved in the production of Beaufort and Beaufighter aircraft in Australia are described and illustrated. Plans for the manufacture by the Beaufort Division of the most modern version of the Lancaster are outlined.

REFERENCE BOOKS

SAE Handbook, 1947 Edition. New York, Society of Automotive Engineers, Inc., 1947. 822 pp., figs., diagrs., tables. $5.00.

STRUCTURES

Note on Fatigue Strength Requirements for Aircraft. B. Lundberg. Montreal, Provisional International Civil Aviation Organization, Airworthiness Division, Second Session, Document No. 2936 AIR-147, March 13, 1947. 23 pp., figs. 5 references. In the introduction existing points of view on methods of dealing with fatigue failure in the vital parts of aircraft are outlined, and the nature of the problem is clarified. The author then explains the present status of the PICAO standards and recommended practices with regard to the fatigue problem and makes some general statements and proposals on the fatigue question with particular reference to future transport aircraft. Different aspects of the subject are discussed, and some results from fatigue research done in Sweden are given. Other sections of the paper deal with the limit lifetime of aircraft in respect to fatigue; different ways of defining fatigue factors of safety; suggestions regarding the magnitude of the factor; and points of view on repeated load tests.

Proceedings of the Society for Experimental Stress Analysis. Vol. 4, No. 2. C. Lipson and W. M. Murray, Editors. Cambridge, Mass. Addison-Wesley Press, Inc., 1947. 121 pp., illus., figs. $6.00. A collection of twelve papers read before the Society: "Fatigue Tests of Major Aircraft Structural Components," by W. G. Pierpont; "Precision Determination of Stress-Strain Curves in the Plastic Range," by John R. Low, Jr., and Frank Garofalo; "A Method of Detecting Incipient Fatigue Failure," by Henry W. Foster; "A Machine for Fatigue Testing Full-Size Parts," by A. F. Underwood and C. B. Griffin; "Some Repeated Load Investigations on Aircraft Components," by S. A. Gordon; "Stress Analysis Utilization in Dynamic Testing," by Roy W. Brown; "Device for Maintaining Continuous Electrical Connections with Reciprocating Engine Parts," by W. A. Wallace and W. A. Casler; "Evaluation of Various Methods of Rotor Blade Analysis by Means of a Structural Model," by Robert Mayne; "Reluctance Gages for Telemetering Strain Data," by W. H. Pickering; "The Linear Variable Differential Transformer," by Herman Schaevitz; "Design and Application of Accelerometers," by David E. Weiss; and "Aircraft Instruments for Radio-Telemetering and Television-Telemetering," by Carl L. Frederick. Also included are a list of corporate members, a history of the Society, and a list of members.

WORLD WAR II

Slipstream; A Royal Air Force Anthology. Edited by R. Raymond and David Langdon. London, Eyre and Spottiswoode, 1946. 260 pp., illus. 10*s.* 6*d.* A collection of 60 stories and articles selected from wartime issues of the official *Royal Air Force Journal*. The stories were written by R.A.F. personnel and cover a variety of topics dealing with service life and R.A.F. activities in all theaters of operation.

Air University, Tyndall Field. Baton Rouge, Army and Navy Publishing Co., 1947. 89 pp., illus. $5.00. An illustrated review of the organization and activities of the Air University and the history of Tyndall Field, Fla. Sections are devoted to the Air College, Air Command and Staff School, Air Tactical School, A.A.F. Special Staff School, and Educational Advisory Staff.

WRITING

Writing the Technical Report. J. Raleigh Nelson. 2nd Ed. New York, McGraw-Hill Book Co., Inc., 1947. 388 pp., diagrs. $3.00.

In this second edition the analysis of fundamental processes involved in the preparation of the technical report has been thoroughly revised and closer correlations have been made between the theoretical portion of the text and the practical illustrations. The main topics of discussion include the design of the report, suggestions as to the form and style of the report, the criticism of the report, and suggestions for class use.

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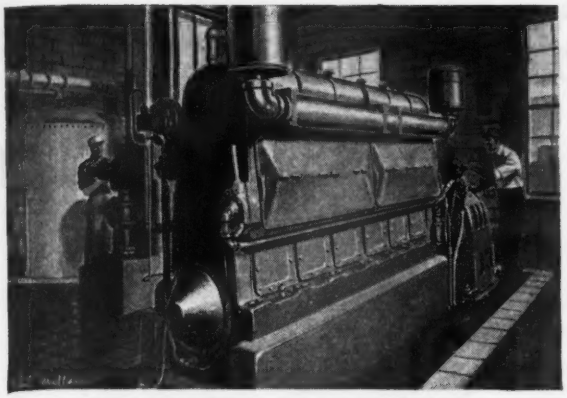

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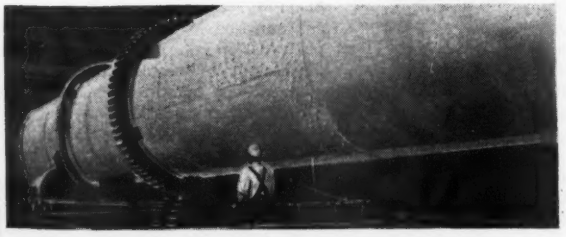

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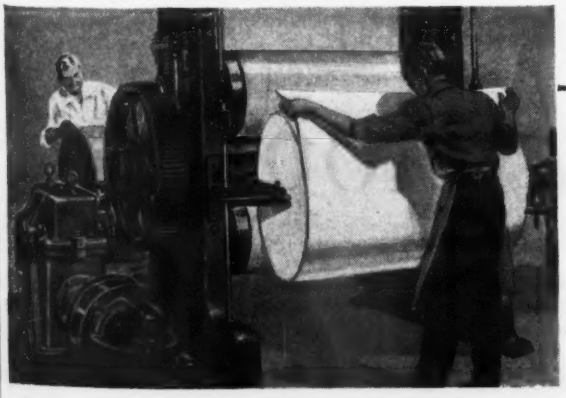

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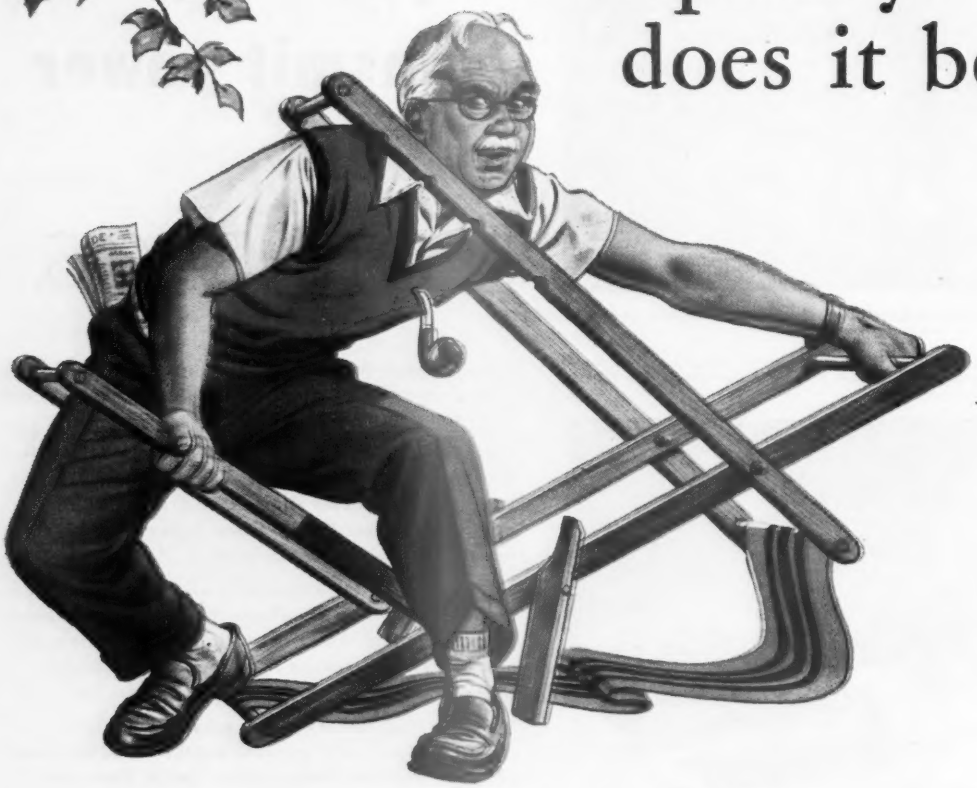

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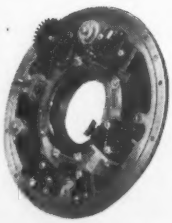

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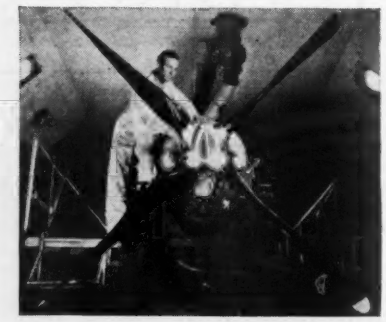

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Index to Advertisers

A

★Adel Precision Products Corporation 14
Aeroproducts Division, General Motors Corporation 86
AiResearch Manufacturing Company Division, The Garrett Corporation 42, 43
★Aluminum Company of America 74, 75
American Metal Hose Branch, The American Brass Company 56

B

Beech Aircraft Corporation 48
Bell Telephone Laboratories 68
Bunhill Publications Limited 70

C

★Champion Spark Plug Company 62
Chance Vought Aircraft Division, United Aircraft Corporation 48
Consolidated Engineering Corporation 12
Curtis Universal Joint Company Inc. 64
Curtiss-Wright Corporation, Wright Aeronautical Corporation Division ..... Back Cover

D

Doelcam Corporation 58
Dow Corning Corporation 70

E

Eagle Pencil Company 50
★Eaton Manufacturing Company, Valve Division 66
★Electrol Incorporated 88
Engineering Consulting Group 77

F

Fairchild Engine and Airplane Corporation
Fairchild Aircraft Division 38
Nepa Division 80
Fenwal Incorporated 44
J. Robert Fischel 77
Foote Bros. Gear and Machine Corporation 85

G

G & O Manufacturing Company, The 80
Garrett Corporation, The, AiResearch Manufacturing Company Division 42, 43
General Motors Corporation, Aeroproducts Division 86
Gits Brothers Manufacturing Company 78
★B. F. Goodrich Company, The, Aeronautical Division ... 32

I

International Nickel Company, Inc., The ..... Inside Back Cover, 36, 60

L

Lamb Electric Company, The 72
Harold M. Lewis 77
Luttrell & Senior, Inc. 77

M

Glenn L. Martin Company, The 52

N

Nepa Division, Fairchild Engine and Airplane Corporation 80
North American Aviation, Inc. 48

P

★Pacific Gear & Tool Works, Western Gear Works 54
Pacific Scientific Company 34
Vic Pastushin Industries, Inc. 80

R

★John A. Roebling's Sons Company, Aircord Division ... 26

S

★Sensenich Corporation 4
★Simmonds Aerocessories, Inc. ..... Inside Front Cover
★Solar Aircraft Company 30
★Sperry Gyroscope Company, Inc., Division of The Sperry Corporation 1

U

United Aircraft Corporation, Chance Vought Aircraft Division 48
United States Aviation Underwriters Incorporated 80

V

★Vickers Incorporated 2

W

★Western Gear Works, Pacific Gear & Tool Works 54
★Weston Electrical Instrument Corporation 46
Whipple and Company 77
Wm. R. Whittaker Company, Ltd. 82
Wright Aeronautical Corporation Division, Curtiss-Wright Corporation ..... Back Cover

Y

Young Radiator Company 64

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